Department of Electrical and Computer Engineering

Undergraduate Student Advising Manual

Computer Engineering

(Reviewed August 2019)

Department of Electrical and Computer Engineering
The Johns Hopkins University

Accredited Undergraduate Program in Computer Engineering

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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 advisor, 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 SMT equipment; a 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 SMD components 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, and Microprocessor/FPGA Laboratory.

The Electrical and Computer Department employs a **Senior Lab Engineer,** 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 their labs in Malone 122/322. Submit an account request form available at: http://www.cs.jhu.edu/lab-info/csg/cstools/forms/newacctform.pdf) and have it signed by CS Professor Joanne Selinski.

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 pair each undergraduate student with a research

laboratory and/or involve them 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 succeeding 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 the Engineering Accreditation Commission of ABET, http://www.abet.org. As part of the ABET requirements, the Electrical 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 http://eng.jhu.edu/wse/page/conduct-of-research-training. Successful completion of this course must be verified before a student's diploma is issued.

1.3.   Advising

The Department's faculty coordinator for undergraduate advising is the Director of Undergraduate Studies, Professor Trac Tran, whose office is in 215 Barton Hall, telephone 410-516-7416, e-mail trac@jhu.edu.

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 faculty advisors. Each student and faculty advisor must consider our objectives and outcomes in planning a set of courses and projects that will satisfy degree requirements. The sample programs and the program checklist used by the faculty advisors illustrate course selections that will help students meet the program objectives and outcomes.

1.3.1.   Visit Your Advisor Often

All incoming freshmen and transfer students will be advised by Professor Ralph Etienne-Cummings, the ECE Department Chair, and Professor Trac Tran, the Director of ECE Undergraduate Studies and Department Advising Coordinator. Upon entering their sophomore year, students will be asked to choose a faculty advisor based on their preference, or will be assigned another faculty advisor randomly. A student may change his faculty advisor at any time by contacting Dana Walter-Shock, Academic Program Administrator. Her office is in 117B Barton Hall, telephone 410-516-7033, email: dwalte10@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 advisor 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 advisor. Students should also be familiar with requirements outlined in the University's Undergraduate Academic Manual http://www.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 advisor 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 advisor 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 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.

From this mission statement, the Computer Engineering faculty has determined 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 **Computational Models for ECE (520.123), 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 (500.112), it will count as a CS credit, even though it has a general engineering number (500.xxx). Please be sure to 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 if you want to count this towards CS/ECE requirements.

- 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 Computer Science, ECE, Applied Mathematics and Statistics, or General Engineering. 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 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), 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, chemistry, biology, earth and planetary sciences), which must include **General Physics (171.101-102), General Physics Laboratory (173.111-112), and Introductory Chemistry (030.101)**. **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.) 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 should take at least three (3) courses in a specific area with at least one of them at an advanced level (300 or 400 level).

- At least two (2) writing intensive (W) courses are required (at least 3 credits each). **The writing intensive courses cannot be taken Pass/Fail and require a grade of C- or better.** Students may wish to consider a course in Technical Communications to fulfill one of the W 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

It is possible that, by completing more than 126 credit hours in their program of study, students may be able to satisfy the requirements of other degree programs offered by the University. These include the B.A. and B.S. degree programs offered in the Department of Electrical and Computer Engineering and the Department of Computer Science. Qualified students may also be eligible for admission to concurrent B.S. / M.S.E. degree programs offered by both departments that will result in an M.S.E. degree in either Electrical Engineering or Computer Science. Students are urged to consult with their advisors regarding these opportunities.

Please note: The requirements listed below are for an M.S.E. degree from the ECE Department. Please consult with the CS Department for their M.S.E. requirements

3.1.   *Eligibility and Application Process*

This program is available *only* to Electrical Engineering or Computer Engineering majors at the Johns Hopkins University with a GPA of 3.5 or higher.

The latest deadline to apply is the end of their second to last semester.

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

3.2.   *Whiting School 50% Tuition Fellowship*

The Whiting School of Engineering will provide a 50% tuition fellowship to all Johns Hopkins alumni who have completed eight semesters. ECE B.S. / M.S.E. students will be eligible for this fellowship beginning their ninth semester.

3.3.   *Requirements*

To meet the requirements for the combined B.S. / M.S.E. degree, the program (in addition to the requirement of the B.S. degree stated above), must include:

- Satisfactory completion of eight one-semester graduate courses. WSE courses must be 600 level or above. Any Arts and Sciences courses must be 400 level or above. All require advisor approval. At least five of these courses must come from the full-time ECE department (520.xxx) but cannot include Independent Study, Dissertation Research, ECE Seminar or Special Studies; ECE Seminar, the required ethics course and other 1 credit reading/recitation courses cannotbe used to fulfill the course requirements and,

- Fulfilling <u>one</u> of the following three requirements:

- Fulfilling <u>one</u> of the following three requirements:

  (1) Satisfactory completion of two additional graduate courses (xxx.400-xxx.799) approved by the advisor, one of which must come from the full-time ECE department (520.xxx) but cannot include Independent Study, Dissertation Research, ECE Seminar or Special Studies; or
  (2) Write an M.S.E. essay (the official title of 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://guides.library.jhu.edu/etd/formatting; or

  (3) Completion of a special project acceptable to a member of the ECE faculty and writing the corresponding report. A copy of this report must be submitted to the ECE office and becomes a permanent part of the student's record.

- A course (including independent study) is satisfactorily completed if a grade of A+ to C- or "P" is obtained. No more than one C grade (C+, C, or C-) can be counted toward the requirements; a grade of D or F or two C+, C, or C- grades will receive notification (with a copy to his or her advisor) of academic performance concerns and an explanation that a second D or F or a third C+, C, or C- grade for a master's student will result in termination from the program.

- At least six one-semester courses in the M.S.E. program must be offered by the ECE Department that are not Independent Study (cannot include Engineering for Professionals (EP) courses).

- No more than two courses may be chosen from the part-time Engineering for Professionals (EP) program.

- 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 part of the student's permanent file.

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, 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 Article IV 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 Article III." Students may obtain a copy of the Constitution of the Ethics Board from the JHU Office of Academic Advising, Garland Hall, Suite 3A. http://e-catalog.jhu.edu/undergrad-students/student-life-policies/

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). Applications are available in 105 Barton Hall or at any of the regular meetings of the chapter.

5.2. *Eta Kappa Nu*

The department sponsors a Chapter of Eta Kappa Nu, the Electrical Engineering honor society. Students with outstanding academic records are invited to join during their junior and senior years.

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 senior is awarded the Electrical and Computer Engineering Student Leadership Award for leadership and service to the department. The Muly

Family Undergraduate Research Award is given to an exceptional senior for conducting research in the Department. The Innovative Design Award is given to the team with the best design in the fall Mechatronics class.

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 (103 Shaffer Hall) has general responsibilities for all engineering majors in the Whiting School of Engineering: http://engineering.jhu.edu/academic-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 advisor. 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 (Garland Hall, Suite 3A) provides the following services for engineering students: http://www.jhu.edu/~advising/index.html

- 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.

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-administered programs or in employment. Accordingly, the University does not take into consideration personal factors that are irrelevant to the program involved.

Questions regarding access to programs following Title VI, Title IX, and Section 504 should be referred to the Affirmative Action Officer, 205 Garland Hall, 410-516-8075.

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 http://web.jhu.edu/disabilities/index.html, or contact them at 410-516-4720 or studentdisabilityservices@jhu.edu. You may also visit their office in 103 Shaffer Hall.

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, Garland Hall 385, (410) 516-4720, tmassie1@jhu.edu. A guide for students can be found here: http://web.jhu.edu/administration/jhuoie/disability/accommodations_students.html

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

1. The student completes:

- 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. and B.A. degrees that is sent to the ECE Department.

- You should forward a copy of your check sheet to Dana Walter-Shock, Academic Program Administrator. She will then audit your file and ensure that all requirements will be met by the end of the semester. That file will also be reviewed by the DUS and Chair, and then forwarded to WSE Undergraduate Studies for final conferral.

2. The student then:
   - Should look for an e-mail from Dana confirming that all requirements will have been met in time for graduation.

   - Completes the"Senior Exit Survey for the Computer Engineering Program" online.

   - Meets with Professor Ralph Etienne-Cummings, ECE Chair, to discuss the student's experience at Hopkins.

   - Notes:

     - **The deadlines to apply for graduation are posted on the Registrar's website.**

     - Departmental Honors are only given for **first majors**, and only when the GPA is at least 3.5.

9. SAMPLE PROGRAMS

The following tables show sample programs fulfilling the requirements of the B.S. degree in Computer Engineering. The programs are oriented toward different concentrations of interest for illustrative purposes only. All students are expected to plan, in consultation with their faculty advisors, programs best suited to their own interests.

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.

Courses that fulfill Advanced Lab Requirement:

ECE Advanced Laboratory or Design Intensive Courses

520.412	Machine Learning for Signal Processing
520.424	FPGA Synthesis Laboratory
520.425	FPGA Senior Projects Laboratory
500.427	Product Design Laboratory
520.433	Medical Image Analysis
520.448	Electronics Design Laboratory
520.450	Advanced Microprocessor Laboratory
520.452/3	Advanced ECE Engineering Team Project
520.454	Control Systems Design
520.462/3	Leading Innovation Design Team (LIDT)
520.483	Bio-Photonics Laboratory
520.491	CAD Design of Digital VLSI Systems
520.492	Mixed Mode VLSI Systems
520.498	Senior Design Project I
520.499	Senior Design Project II

CS Advanced Laboratory Courses

601.421	Object Oriented Software Engineering
601.3/417	Distributed Systems
601.447	Computational Genomics
601.456	Computer Integrated Surgery II
601.461	Computer Vision
601.476	Machine Learning: Data to Models
601.484	Augmented Reality
601.456	Computer Integrated Surgery II
601.461	Computer Vision
601.476	Machine Learning: Data to Models
601.482	Machine Learning: Deep Learning

Other Advanced Laboratory Courses

530.420	Robot Sensors and Actuators
530.421	Mechatronics
530.474	Effective & Economic Design for Biomedical Instrumentation
530.495	Microfabrication Laboratory
540.418/9	Project in the Design of a Chemical Car
580.471	Biomedical Instrumentation II
580.480/1	Precision Care Medicine

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.

Sample Bachelor of Sciences in Computer Engineering Program Microsystems Oriented Emphasis (Courses in **Bold** are required)					
Fall - Year 1			**Spring - Year 1**		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
110.109	**Calculus II**	4	**601.220**	**Intermediate Programming**	**3**
171.101	**Physics I**	**4**	**171.102**	**Physics II**	**4**
171.111	**Physics Lab I**	**1**	**171.112**	**Physics Lab II**	**1**
520.137	Intro to ECE	3	**520.142**	**Digital System Fundamentals**	**3**
500.112	Gateway Computing	3	**520.123**	**Comp. Models for ECE**	3
Total Credits		**15**	**Total Credits**		**14**
Fall - Year 2			**Spring - Year 2**		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
553.291	**Linear Algebra and Differential Eq**	**4**	**110.202**	**Calculus III**	**4**
030.101	Chemistry	3	**601.226**	**Data Structures**	**4**
520.230/231	**Mastering Electronics/Lab**	**4**	**520.214**	**Signals & Systems**	**4**
	H & S Elective 1	**3**	520.216	Intro to VLSI	3
601.229	**Computer Systems Fundamentals**	3		H&S Elective 2	3
Total Credits		**17**	**Total Credits**		**18**
Fall - Year 3			**Spring - Year 3**		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
553.171	**Discrete Math**	**4**	601.318	Operating Systems	4
520.340	Intro. Mechatronics	**3**	**553.310**	**Intro. to Prob. & Statistics**	**4**
	ECE Elective	3	601.414	Computer Networking Fund.	3
520.349	Microprocessor Lab	3		H&S Elective 4	3
	H&S Elective 3	3		Science Elective	3
Total Credits		**16**	**Total Credits**		**17**
Fall - Year 4			**Spring - Year 4**		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
520.424	FPGA Synthesis Lab	3	520.419	Theory and Design of Iterative Algorithms	3
520.491	CAD Design of Digital VLSI	3	520.448	Electronics Design Laboratory	3
530.495	Microfabrication Lab	4	520.492	Mixed Signal VLSI Systems	3
	Non ECE/CS/MathSci Eng. Elective	3		Non ECE/CS/MathSci Eng. Elective	3
	H&S Elective 5	3		H&S Elective 6	3
Total Credits		**16**	**Total Credits**		**15**

You will need to fit in another 4 credits of Math in Spring 1 if you do not transfer any Math credits in.

Sample Bachelor of Sciences in Computer Engineering Program
Computer Integrated Surgery Oriented Emphasis
(Courses in **Bold** are required)

Fall - Year 1			Spring - Year 1		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
110.109	**Calculus II**	**4**	**601.220**	**Intermediate Programming**	3
171.101	**Physics I**	**4**	**171.102**	**Physics II**	**4**
171.111	**Physics Lab. I**	**1**	**171.112**	**Physics Lab. II**	**1**
520.137	Intro to ECE 601.107	3	**520.142**	**Digital System Fundamentals**	**3**
500.112	Gateway Computing	3	**520.123**	**Computational Modeling/ECE**	**3**
Total Credits		**15**	**Total Credits**		**14***
Fall - Year 2			**Spring - Year 2**		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
553.291	**Linear Algebra and Differential Eq.**	**4**	**553.171**	**Discrete Math**	**4**
030.101	**Intro. to Chemistry**	**3**	**601.226**	**Data Structures**	**4**
520.230	**Mastering Electronics**	**4**	**520.214**	**Signals & Systems**	**4**
	H & S Elective 1	3	520.216	Intro to VLSI	3
601.229	**Computer System Fundamentals**	**3**		H&S Elective 2	3
Total Credits		**17**	**Total Credits**		**18**
Fall - Year 3			**Spring - Year 3**		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
553.310	**Intro. to Prob. & Statistics**	**4**	601.318	Operating Systems	3
520.340	Intro. to Mechatronics	3	**110.202**	**Calculus III**	**4**
030.101	**Intro. to Chemistry**	**3**	601.414	Computer Networking Fund.	3
520.349	Microprocessor Lab.	3		H&S Elective 4	3
	H & S Elective 3	3		Science Elective	3
Total Credits		**16**	**Total Credits**		**16**
Fall - Year 4			**Spring - Year 4**		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
520.435	Digital Signal Processingg	3	520.448	Electronics Design Lab.	4
601.461	Computer Vision	3	601.456	Comp. Intg. Surgery II	3
601.455	Comp. Intg. Surgery	4	601.463	Algorithms for Sensor-Based Robotics Domains	3
	Non ECE/CS/MathSci Eng. Elective	3		Non ECE/CS/MathSci Eng. Elective	3
	H&S Elective 5	3		H&S Elective 6	3
Total Credits		**16**	**Total Credits**		**16**

__You will need to fit in another 4 credits of Math in Spring 1 if you do not transfer any Math credits in.__

*__** Students may also take 500.410 Surgery for Engineers (summer, junior/senior year)__*

*__*** One of your Non-ECE/CS/MathSci Engineering Electives should be an advanced lab.__*

Sample Bachelor of Sciences in Computer Engineering Program
Software Oriented Emphasis
(Courses in **Bold** are required)

Fall - Year 1			Spring - Year 1		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
110.109	**Calculus II**	4	**601.220**	**Intermediate Programming**	**3**
171.101	**Physics I**	**4**	**171.102**	**Physics II**	**4**
171.111	**Physics Lab I**	**1**	**171.112**	**Physics Lab II**	**1**
520.137	Intro to ECE	3	**520.142**	**Digital System Fundamentals**	**3**
500.112	Gateway Computing	3	**520.123**	**Computational Models/ECE**	**3**
Total Credits		**15**	**Total Credits**		**15**

Fall - Year 2			Spring - Year 2		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
553.291	**Linear Alg/Diff. Equations**	**4**	**553.171**	**Discrete Math**	**4**
030.101	**Intro. to Chemistry**	**3**	**601.226**	**Data Structures**	**4**
520.230	**Mastering Electronics**	**4**	520.216	Intro to VLSI	3
601.229	**Comp. Sys. Fundamentals**	**4**	520.214	**Signals & Systems**	**4**
	H&S Elective 1	3		H&S Elective 2	3
Total Credits		**18**	**Total Credits**		**18**

Fall - Year 3			Spring - Year 3		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
553.310	**Intro. Prob/Stats.**	**4**	**110.202**	**Calculus III**	4
	ECE Elective 2	**3**		Math Elective	4
	Science Elective	3		ECE Elective	3
601.421	Object Oriented Software Engineering	3		ECE Elective	3
	H&S Elective 3	3		H&S Elective 4	3
Total Credits		**16**	**Total Credits**		**16**

Fall - Year 4			Spring - Year 4		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
601.415	Databases	3	601.418	Operating Systems	3
	Non ECE/CS/MathSci Eng. Elective	3	520.448	Electronics Design Laboratory	3
601.476	Machine Learning: Data to Models	3	520.425	FPGA Projects Laboratory	3
520.424	FPGA Synthesis Lab	3		Non ECE/CS/MathSci Eng Elective	3
	H&S Elective 5	3		H&S Elective 6	3
Total Credits		**15**	**Total Credits**		**15**

Sample Bachelor of Sciences in Computer Engineering Program
Robotics Emphasis
(Courses in **Bold** are required)

Fall - Year 1			Spring - Year 1		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
110.109	**Calculus II**	**4**	**601.220**	**Intermediate Programming**	**4**
171.101	**Physics I**	**4**	**171.102**	**Physics II**	**4**
171.111	**Physics Lab. I**	**1**	**171.112**	**Physics Lab. II**	**1**
520.137	Intro to ECE	3	**520.142**	**Digital System Fundamentals**	**3**
500.112	Gateway Computing	3	**520.123**	**Computational Models/ ECE**	3
Total Credits		**15**	**Total Credits**		**15***
Fall - Year 2			Spring - Year 2		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
553.291	**Linear Algebra and Differential Eq.**	**4**	**553.171**	**Discrete Math**	**4**
030.101	**Intro. to Chemistry**	**3**	**601.226**	**Data Structures**	**4**
520.230	**Mastering Electronics**	**4**	**520.214**	**Signals & Systems**	**4**
	H & S Elective 1	3	520.216	Intro. to VLSI	3
601.229	**Computer System Fundamentals**	**3**		H&S Elective 2	3
Total Credits		**17**	**Total Credits**		**18**
Fall - Year 3			Spring - Year 3		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
	H&S Elective 3	3	601.464	Artificial Intelligence	3
553.310	**Introduction to Probability and Statistics**	4	**110.202**	**Calculus III**	**4**
520.340	Intro. to Mechatronics	**3**		Math Elective	4
	Science Elective	3		H&S Elective 4	3
520.424	FPGA Synthesis Lab	3	520.353	Control Systems	3
Total Credits		**16**	**Total Credits**		**16**
Fall - Year 4			Spring - Year 4		
Number	*Course*	*Credits*	*Number*	*Course*	*Credits*
520.435	**Digital Signal Processing**	**4**	520.448	Electronics Design Lab.	4
601.461	Computer Vision	3	520.454	Control Systems Design	3
530.421	Mechatronics	3	601.463	Algorithms for Sensor-Based Robotics Domains	3
	ECE Elective	3	530.420	Robot Sensors and Actuators	3
	H&S Elective 5	3		H&S Elective 6	3
Total Credits		**16**	**Total Credits**		**16**

10. FREQUENTLY ASKED QUESTIONS

Q: I am a computer engineering major planning to graduate. I have been told that I must meet new requirements that differ from the requirements in effect when I was admitted to the program. I cannot meet all the new requirements and do not want to delay graduation. What should I do?

A: Meet with your advisor and try to meet the new requirements as best as you can. Make a list of the new requirements that you cannot meet and ask for a letter from the chairman waiving those 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 520.315/580.315 Information Processing of Sensory Signals to fulfill the Checklist Section II.A. Engineering Courses from other Depts.

A: No, ECE (520) courses co-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: In order to get a senior design project, you must find a subject for your project and a faculty member willing to supervise you. As both subject matter and faculty sponsorship (not necessarily by an ECE faculty member) of senior design projects must be approved by your faculty advisor, you must discuss your plan with your advisor prior to undertaking the project.

Q: Can Computer Science credits fulfill the requirement of 6 credits of engineering courses from other departments?

A: No. Not for a Computer Engineering Degree.

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

A: A student is allowed (but not encouraged) to take an ECE or CS course pass/fail. In this case, the course **CANNOT** be counted toward the 42-credit BSCE 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.

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 (S), but not as natural science courses (N).

Q: Can I count a course coded (N), (S) as an (N) credit?

A: No. Courses coded NS can be counted as (S), but not as natural science courses (N).

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 BSCE?

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 (171.112).

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 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
   http://www.ece-jhu.org/
   http://engineering.jhu.edu/
   http://engineering.jhu.edu/academic-advising/