ECE Curriculum Revision, Fall 2013

Background/Broad Motivation:

- Students want flexibility and global opportunities.
    - Study abroad – Dialog or semester abroad.
    - Alternative semesters of research or service learning.
- Engineers are far more interdisciplinary.
    - Interdisciplinary/Combine with other disciplines - minors.
    - Transition to learn how to learn balanced with a particular body of knowledge.
- ECE as a discipline is broader than ever.

A few sources: **Northeastern University Long Range Plan**; **National Academy of Engineering Reports**: Educating the Engineer of 2020, The Engineer of 2020, Visions of Engineering in the New Century, How Students Learn; **Report To The President**, Engage to excel: producing one million additional college graduates with degrees in science, technology, engineering, and mathematics, Executive Office of the President, President's Council of Advisors on Science and Technology; **Transformation Is Possible If a University Really Cares**, Jeffrey Mervis, 19 April 2013 Vol. 340, Science; **Feedback from our students**.

Some Goals of the Revised Curriculum:

- Sophomore students understand connections among a broad range of Electrical and Computer Engineering concepts.
    - Provide early, integrated courses with labs to motivate students, make connections within ECE, help students choose area of focus, improve coop preparation, and provide breadth to the EE and CE curricula.
    - Connections within ECE are critical for retention and to help students choose their paths through the wide range of EE and CE areas.
    - Connections with EE faculty and students are critical for retention.
- Offer flexibility, including options for alternative semester or summer experiences.
    - Students can tailor program to interests more easily.
    - Semester abroad or Dialogue or research or service learning or other.
- Build a curriculum that can be modified easily in the future.
- Introduce the "essence of engineering" early.
- Bring the number of credits in line with the national norm.
- Improve sophomore retention in ECE/Engineering.

Changes in the structure of the curriculum:

The changes to the structure of the curriculum are shown schematically below, first as block diagrams and then with course names, numbers, and requirements.

Curriculum Flexibility: The curriculum is made more flexible by: 1) Decreasing the number of required courses; 2) Offering students a choice (of three courses) for one of the required courses; and 3) Reducing the total number of 4-credit courses required by one (31 instead of 32 courses). The reduction by one in the number of courses makes it easier for students to plan a semester abroad, where the appropriate technical courses may be hard to find, or to plan research or service learning semesters. It makes it easier for the student to finish on time even with a change in plans or a problem with a course. Students can choose to take another elective or can reserve extra time for their capstone project and any associated entrepreneurial activities senior year. In addition, the students can take the 32nd course at their option to complete a minor or learn more about a subject of interest.

Number of Credits: The number of credits is reduced from 138 (Computer Engineering) or 139 (Electrical Engineering) to 132 because of the 4-credit course reduction described above, by integrating lab components into one core course in a 4-credit model rather than a 5-credit model, and by moving one course (CE) or two courses (EE) with associated lab(s) to technical electives. This reduction brings us more in line with national norms for credit hours.

Broad Introductory Courses; "the essence of engineering:" The two courses our students take first are the two broad introductory sophomore courses. These courses are designed to provide breadth in the curriculum, to introduce students to a broad range of electrical and computer engineering including connections between topics, and to give students an early design-oriented lab experience that is an integral part of the course. One of the courses is has a focus on circuits and signals (electrical engineering) and the other course focuses on embedded system design, both software and hardware (computer engineering). In both courses, the instructor has regular classroom days and one lab/active learning day per week (two regular classroom days/week for the CE course and three regular classroom days/week for the EE course. The same professor and TAs work on the whole integrated course, and upper class undergraduates help with the lab/active learning day. This course structure keeps all elements of the course tightly coordinated and promotes connections between the sophomore students and the other groups within ECE: Faculty, upper class undergraduates, and graduate students. Retention is addressed through establishing connections with faculty and students in the department, by involving the students in real electrical and computer engineering at the beginning of the program (the essence of engineering), and by keeping the workload in these challenging first courses reasonable.

Fundamentals Courses:

The fundamentals courses are another part of the core curriculum. In EE, they are Fundamentals of Electronics, Fundamentals of Linear Systems, and Fundamentals of Electromagnetics. These three courses are quite similar to our current core courses in these areas, although Electronics and Linear Systems are changing slightly. In CE, they are Fundamentals of Digital Design and Computer Organization, Fundamentals of Engineering Algorithms, and Fundamentals of Networks. In addition to

the EE fundamentals courses, the EE students must take one of the CE fundamentals courses and the CE students must take one of the EE fundamentals. The fundamentals courses are prerequisites for the ECE technical electives.

Science and Mathematics Courses:

No change.

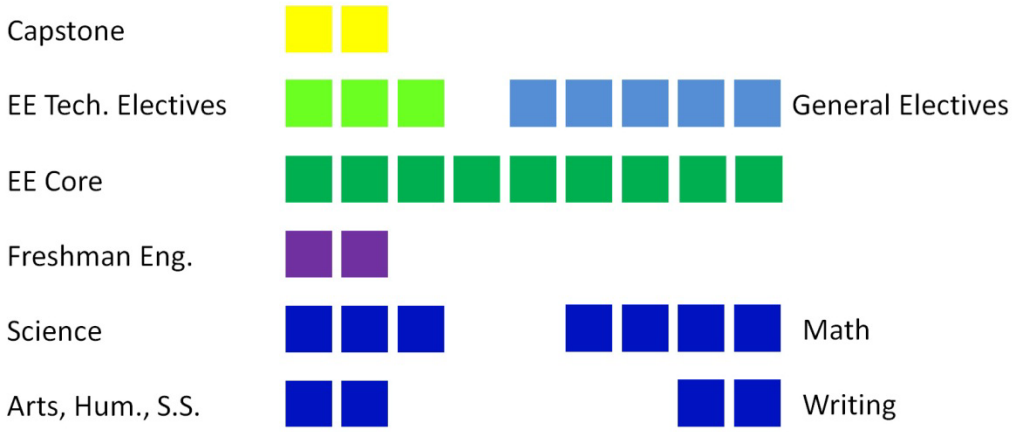
Computer Science Courses:

The material from courses CS1500/1501, Algorithms and Data Structures for Engineering and Lab will be primarily covered in a hands-on format in the required sophomore introductory course EECE 2160/2161, Embedded Design: Enabling Robotics and Lab. Fundamentals of Engineering Algorithms, which covers the same material as the current EECE 3326 Optimization Methods, may need some minor adjustments since the entry point for students may be slightly different. Students who want further software background will be advised to take computer science courses. Elective courses within Computer Science are unchanged.

Writing Social Sciences and Humanities:

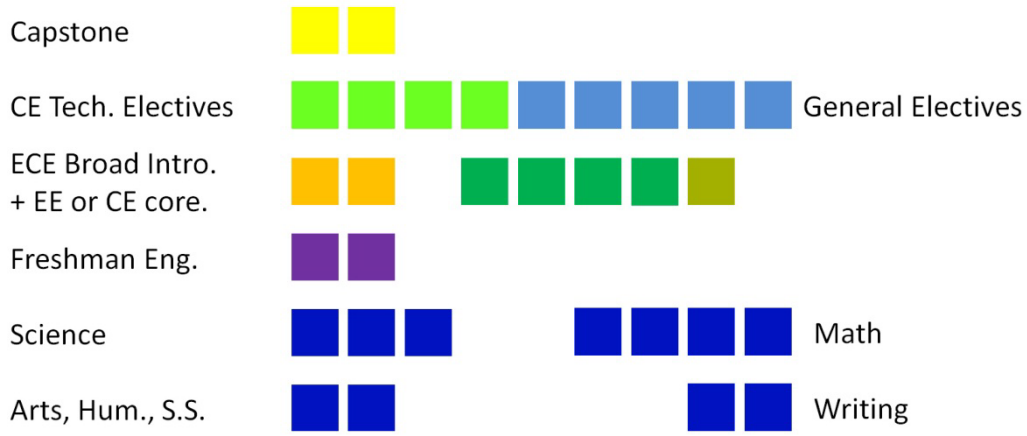
No Change.

Current Curricular Structure, BSEE



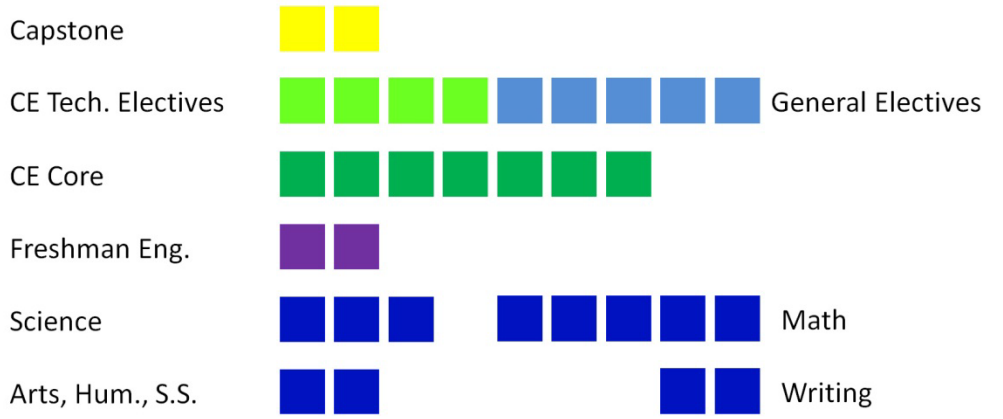
32 four-credit courses + 11 one-credit extras = 139 credits

New Curricular Structure, BSEE



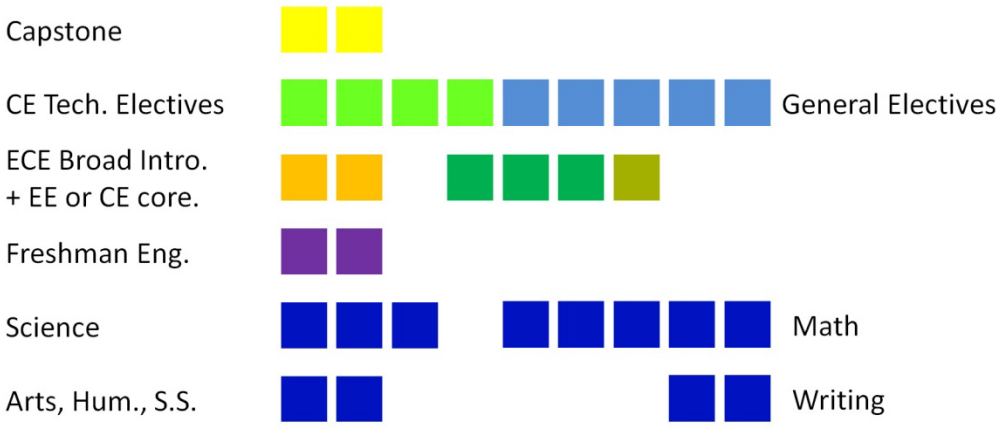
31 four-credit courses + 8 one-credit extras = 132 credits

Current Curricular Structure, BSCE



32 four-credit courses + 10 one-credit extras = 138 credits

New Curricular Structure, BSCE



31 four-credit courses + 8 one-credit extras = 132 credits

New ECE Curriculum with requirements