School of Engineering Curriculum Committee
2006-2007 Year-End Report

This has been a busy year for the School of Engineering Curriculum Committee; we both adopted some of the initiatives from the Curriculum Task Force headed by Lewis Edgers, and also worked upon our own initiatives separate from those raised by the Task Force.

The implementation of the revised freshman program in engineering required deciding the details for a few parts. In the spring of 2006, the faculty of the School of Engineering voted to change the program as follows:

- Move “Engineering Graphics and CAD (EN2)” from spring to fall,
- Replace EN1 with a new one-credit “Introduction to Computing” in the spring.
- Limit ½-credit Engineering electives to the fall term.

In the fall, many issues still remained as to how to implement this proposal. A key question for the committee was how one can assure quality of the ½-credit electives. The committee voted to take ownership of this issue, and to review ½-credit courses in the future, replacing the former process in which departments develop listings without reference to the committee. The committee discussed several details of this process, including:

- How we can better manage and oversee the ½-credit electives?
- What standards should apply to ½-credit electives?
- How we can assure that every ½-credit elective meets these standards?

The committee considered standards for the ½-credit electives based upon guidelines for “project-based learned” presented by the Subcommittee on Project-Based Learning of the Curriculum Task Force, modified those standards slightly, and presented them to the faculty, who made further modifications and approved the standards. The committee will implement those standards during the 2007-2008 school year, so that the standards will be in force for the fall 2008 ½-course electives.

Another key discussion was of the humanities and social sciences requirement for all Engineering students. The former requirements were based upon ABET standards that are no longer in force, and were in practice difficult to implement. A sub-committee worked out new standards, which were presented to the faculty, tuned again, discussed again in committee, and finally accepted by the faculty as applicable to the class matriculating in 2008. The new requirements:

- Require one course in Social Sciences.
- Require one course in Humanities (excluding Arts not listed as Humanities)
- Allow three other courses to be chosen from Humanities, Social Sciences, and Arts, without restriction.
- Require at least two courses to be taken from the same department.
- Exclude Experimental College courses.

These new requirements allow students to count courses from the performing arts and design, which were formerly excluded, but also require each student to take a true humanities course.
As part of the Curriculum Task Force work on revising freshman Mathematics, the Mathematics department presented a proposal to improve Calculus II for the specific audience of engineering students. Math12A is a proposed variant of Math12 (Integral Calculus) that would:

- Review all of Math11 (Differential Calculus) in an accelerated fashion appropriate for the large population of engineering students who have advanced placement credit in Mathematics and/or some exposure to calculus before entering Tufts.
- Include extra laboratory work with applications in engineering and the sciences.
- Better prepare students to apply calculus to engineering problems.

The committee and faculty enthusiastically approved the Math12A proposal; it now awaits implementation by the Mathematics department. A pilot course might be taught in the spring of 2008.

The Physics department also asked the curriculum committee for input in their process of revising Physics 12 (Electromagnetics). We convened a subcommittee to study the existing course, and could not find any recommendations that we believe would improve it. We thank Physics for including us in the process; both the committee and the faculty of the school of engineering passed a resolution thanking Physics for including us in their curriculum revision process.

A final discussion (and one that is still ongoing) concerns how to appropriately expose engineering students to biology. A Curriculum Task Force Subcommittee on Biology for Engineers proposed a new course “Engineering Science 11: Fundamentals of Biological Systems for Engineers” that replaces the former ES11 and is not cross-listed with Biology. The new course has been approved as a course by the committee and the faculty, and will be piloted in the spring of 2008. There is an ongoing discussion as to whether this course should be required of all engineers. This discussion is not complete at this time, and will continue next year.

Changes in the syllabi for the following courses were approved by the committee and the faculty of the School of Engineering:

- EN ½ courses must have a project component by at latest Fall 2008.
- ES 2: Introduction to computing for engineers (renumbered from EN1 to avoid confusion).
- ES 3: Introduction to electrical systems with lab.
- ES 10: Introduction to materials science for chemical and biological engineers (changed from ½ credit to 1 credit).
- ES 11: Fundamentals of biological systems for engineers (no longer cross-listed as Biology 1).
- ES 88: CAD for engineers
- COMP 131: Artificial intelligence
- EE 13: Circuit theory

The following courses were renumbered and/or renamed:

- EN1 became ES2.
- CE102 became ES56.
EE27 became EE127.
EE298, EE299 changed name from “Graduate Research” to “Doctoral Thesis”.
The following minor program changes were made:
- In the Computer Engineering (BSCPE) program, EE103 became required, EE107 became elective.

The following new courses were approved by the committee and the faculty of the School of Engineering:
- EN 74-ECE: Introduction to image processing.
- BME 141: Analytical tools for biomedical engineering.
- BME 165: Principles of controlled release and drug delivery.
- COMP 14: Computational concepts in biological and cognitive sciences.
- COMP 120: Web engineering.
- COMP 135 Introduction to machine learning and data mining.
- COMP 140 Advanced computer architecture.

Respectfully submitted,
Alva L. Couch
Chair, SOECC
Appendix: list of bulletin language changes approved by the committee.

Changes to existing courses:

**ES 3: Introduction to Electrical Systems w/lab.** Definitions of circuit elements, fundamental laws, selected network theorems, controlled sources, introduction to the oscilloscope, energy and power, natural response and complete response of first order circuits, steady state sinusoidal behavior, algebra of complex numbers, phasors, impedance, average and reactive power, introduction to analog and digital systems, frequency response and filters, measurements and instrumentation, introduction to computer applications for circuit analysis and design. Associated laboratory project work. Prerequisite: must be preceded or accompanied by Math 12. *Members of the department.*

**ES 10: Introduction to Materials Science.** Structure of materials; chemical composition; phase transformations; properties of metals, ceramics, polymers, biopolymers, and related materials. Material selection in chemical and biological engineering applications. Prerequisites: Math 12, Chemistry 1 or 16. *Members of the department.*

**ES 11: Fundamentals of Biological Systems for Engineers.** Fundamentals of biology in the context of engineering disciplines. Chemical and physical mechanisms underlying biological functions in complex environments. Case studies of relevance in various engineering disciplines, with a focus on cells and information transfer. May not be counted toward the Biology major. One may not receive credit for both ES11 and Biology 13. Potential premedical students are advised to take Biology 13 instead of this course. Prerequisites: Math 12, Physics 11, and Chemistry 1.

**ES 88: CAD for Engineers.** Two-and three-dimensional geometric modeling with computer-aided design (CAD) systems. The use of CAD technology for the design and analysis of civil structures and mechanical assemblies. Topics covered include; creating engineering drawings from CAD models, digital terrain modeling, parametric feature-based solid modeling, constraint-based assembly modeling, spline technology and the modeling of sculptured surfaces, CAD photorealism, and animation for engineering applications. Prerequisite: EN 2. *Minardi*

**COMP 131: Artificial Intelligence.** History, theory, and computational methods of artificial intelligence. Basic concepts include representation of knowledge and computational methods for reasoning. One or two application areas will be studied, to be selected from expert systems, robotics, computer vision, natural language understanding, and planning. Prerequisites: Comp 15 and either MATH 22 or familiarity with both symbolic logic and basic probability theory. *Members of the department.*

New courses:

**EN 74-ECE: Introductory Image Processing.** Processing and analysis of multidimensional signals. How our 3D world is represented as a 2D image. Removing noise, automatically finding important image features, and improving contrast and color structure. Applications include removing red-eye from snapshots, quantifying climate change from satellite data, and fusing information from multiple sources. One-half course credit. *Miller.*

**ES 2: Introduction to Computing in Engineering.** An introduction to engineering problem-solving with the aid of computational software. Emphasis upon efficient and accurate calculations, rudimentary numerical and data analysis methods including curve fitting, optimization, equation solving, computer calculus, and statistics. Examples drawn from a variety of engineering disciplines show the uses of iteration, number representation, arrays, modularization, and structured programming techniques. The characteristics of object-oriented programming, event-driven control, and graphical user interfaces are also explored. Prerequisite: Math11, Co-requisite: Math12. *Spring. Minardi.*

**BME 141: Analytical Tools for Biomedical Engineering.** Statistical methods of data analysis with emphasis upon biomedical applications. Probability, interpretation of diagnostic tests (sensitivity, specificity, predictive values), random variables, covariance and correlation, normal distribution, samples, error analysis and propagation of errors, statistical tests, method of least squares, linear regression, independent component analysis, principal component analysis, and noise reduction in biomedical data. Students are required to review, critique, and prepare written and oral reports of selected research articles published in the literature. *Prerequisites: Physics 12 and Mathematics 38, or consent. Fantini.*

**BME 165: Principles of Controlled Release and Drug Delivery.** Fundamentals of drug product development and formulation with particular emphasis on novel and developing technologies for controlled release and drug delivery for biopharmaceuticals. Course includes coverage of formulation principles and discussion of the interplay between physiology, pathophysiology and dosage form development, pharmacokinetics, and novel materials used in controlled release. Prerequisites: Chemistry 1 or 16, Biology 13 or Engineering Science 11, Engineering Science 2, and Math 12, or consent. *Members of the department.*

**COMP 14: Computational Concepts in Biological and Cognitive Sciences.** A second course in Computer Science for interdisciplinary students in the biological and cognitive sciences. Programming skills relevant to problems in biology and cognitive science, including data structures, algorithms, algorithm analysis techniques, discrete mathematics, and probability. Students will complete programming projects inspired by these disciplines. Note that students majoring or double-majoring in computer science (even those interested in computational biology or cognitive science) should not take this course, as they are required to take both COMP 15 and MATH 22 instead. Prerequisite: COMP 11 or equivalent. *Blumer.*

COMP 135: Introduction to Machine Learning and Data Mining. An overview of methods whereby computers can learn from data or experience and make decisions accordingly. Topics include supervised learning, unsupervised learning, reinforcement learning, and knowledge extraction from large databases with applications to science, engineering, and medicine. Prerequisites: Comp 15 and Math 22 or consent (Comp 160 is highly recommended). Members of the department.

COMP 140: Advanced Computer Architecture. Elements of modern computer architectures, including instruction pipelining, memory hierarchy, instruction-level parallelism, threading, and multi-core processors. Architectural issues related to software optimization. Architectural design decisions and how they affect operating systems and compilers. Quantitative analysis and evaluation of modern computing systems, including selection of appropriate benchmarks to reveal and compare the performance of alternative design choices in system design. Prerequisite: Comp40. Hassoun.

Humanities, Social Sciences, and Arts Requirement

This requirement consists of five credits. With the aid of a faculty adviser, the student selects courses to promote breadth and depth in intellectual development. The courses selected must include a minimum of one credit in the areas of humanities and social sciences. In addition, at least two courses must be offered by the same department. For the list of acceptable courses, see the section on the distribution requirement – humanities, social sciences, and arts – in the bulletin under College of Liberal Arts Information. In addition to courses fulfilling the humanities requirement for the College of Liberal Arts, all levels of foreign language and English are accepted for the humanities requirement. Ex-college courses are excluded, including those approved for distribution credit by the College of Liberal Arts. The student has the option to satisfy these requirements through a special minor in foreign language and culture in the areas of Chinese, French, German, Hebrew, Italian, Japanese, Russian, or Spanish. Contact the Department of German, Russian, and Asian Languages and Literatures, or the Department of Romance Languages for details.