The Franklin W. Olin College of Engineering

The Franklin W. Olin College of Engineering is an undergraduate institution dedicated to the growth of individuals who will innovate, create, and manage the technologies of the future. Engineering education at Olin is in the liberal arts tradition, with a strong emphasis on the Arts, Humanities and Social Sciences. Olin is committed to preparing graduates who recognize the complexity of the world, who appreciate the relationship of their work to society, and who are dedicated to creative enterprises for the good of humankind. Olin College endeavors to provide its education at little or no cost to the student.

Olin College strives to foster in students:

- a deep appreciation and comprehension of the principles of engineering analysis and design;
- a broad knowledge of social and humanistic contexts;
- the ability to articulate a vision and see it to fruition;
- dedication to intellectual vitality, community involvement and lifelong personal growth.

This document represents a draft of Olin College's four-year curriculum. As continual improvement is a founding precept of Olin College, all listed policies, degree requirements, and course listings remain subject to revision.

Curriculum Fundamentals

Olin's progressive educational perspective has shaped a curriculum with several distinctive features:

- Hands-on, project-oriented course work that integrates the pedagogies and practices of design, engineering analysis, mathematics, science and entrepreneurship. From the outset, Olin engineers study design by actually designing, building, and testing real systems. This practical focus is ongoing, with students undertaking significant design projects over the course of their four years.
- Connection building between fundamental science, mathematics, and engineering; between different fields of engineering; between the arts, humanities and social sciences and technical disciplines; and between business, entrepreneurship, and technology. As a result, the Olin curriculum is conceived and taught in a highly interdisciplinary way.
- Purposeful decentralization of writing and speaking instruction, making the mastery of communication skills a joint faculty project.
- A focus on entrepreneurship as a process of fulfilling human needs and creating value. Students acquire entrepreneurial skills through a process of learning by doing. Outcomes are assessed and fed back through intensive coaching.
- Opportunity for significant independent study or research, in addition to the experiences of team membership and team leadership.

Graduation Requirements

Olin College offers undergraduate programs leading to the Bachelor of Science degree with specific majors in Mechanical Engineering, Electrical and Computer Engineering, and Engineering. The curriculum is designed to be flexible with decisions on precise course selection left to students and their advisors. All students must meet some common degree requirements and each degree program has additional requirements detailed below.

In order to graduate from Olin College, a student must, at minimum, meet the following requirements:

- Demonstration of mastery of required foundation material. Most students will achieve this through satisfactory completion of the following courses:
  - Mathematical Foundations of Engineering (2 courses)
  - Physical Foundations of Engineering (2 courses)
  - Foundation Design Projects (3 courses)
  - Introduction to Modeling and Control (1 course)
  - Applied Mathematical Methods (1 course)
  - Signals and Systems (1 course)
  - Principles of Materials Science and Applied Chemistry (1 course)
  - Principles of Modern Biology (1 course)
  - Foundations of Business and Entrepreneurship (1 course)
  - Sophomore Design Project (1 course)
- Completion of 7 courses of Arts, Humanities, and Social Sciences (AHS) in a manner that satisfies the AHS requirements listed below.
- Completion of an AHS Capstone project (1 course).
- Completion of 6 courses of major-specific core material.

- Completion of 3 courses of major-specific elective material.
- Completion of a Senior Capstone Project (equivalent of 5 courses).

Most Olin courses occupy an average of ten hours of student time each week. Olin students can undertake a maximum of five courses in a semester, corresponding to about fifty hours of academic work each week. This total does not include Passionate Pursuits, research, or independent study (described below).

Curriculum Profile

Figure 1 illustrates a sample program of study that would enable a student to satisfy all Olin degree requirements in four years while preserving the option of a semester away, such as an internship or study-abroad experience. The main features of the curriculum are described below.

Integrated Course Blocks that Incorporate Hands-On Projects

Major portions of the curriculum are taught in integrated course blocks, in which multiple faculty members collectively develop synchronized courses in conjunction with a hands-on project. These blocks enable tight coordination between the understanding of underlying disciplines and the application of disciplinary knowledge to real engineering problems. In addition, course blocks provide improved tracking of student progress, lead to integrated learning, encourage strong student support networks, and allow for innovation in delivery. Course blocks also develop specific engineering and entrepreneurship skills, such as opportunity assessment, computer aided design and fabrication techniques.

In the freshman year, the integrated course block connects mathematics and physics with design projects. The efficacy of this format allows students to directly apply physics and math to a substantial engineering design project. For example, students learn techniques for solving differential equations at the same time that they need differential equations to describe physical systems.

The integrated course block in the fall semester of the sophomore year combines science and engineering with courses in the Arts, Humanities, and Social Sciences (AHS) or in business, allowing students to work on engineering projects that have broader implications than the purely technical. Sophomore students choose from integrated combinations such as *Materials Science* and *History of Technology*. Regardless of which integrated

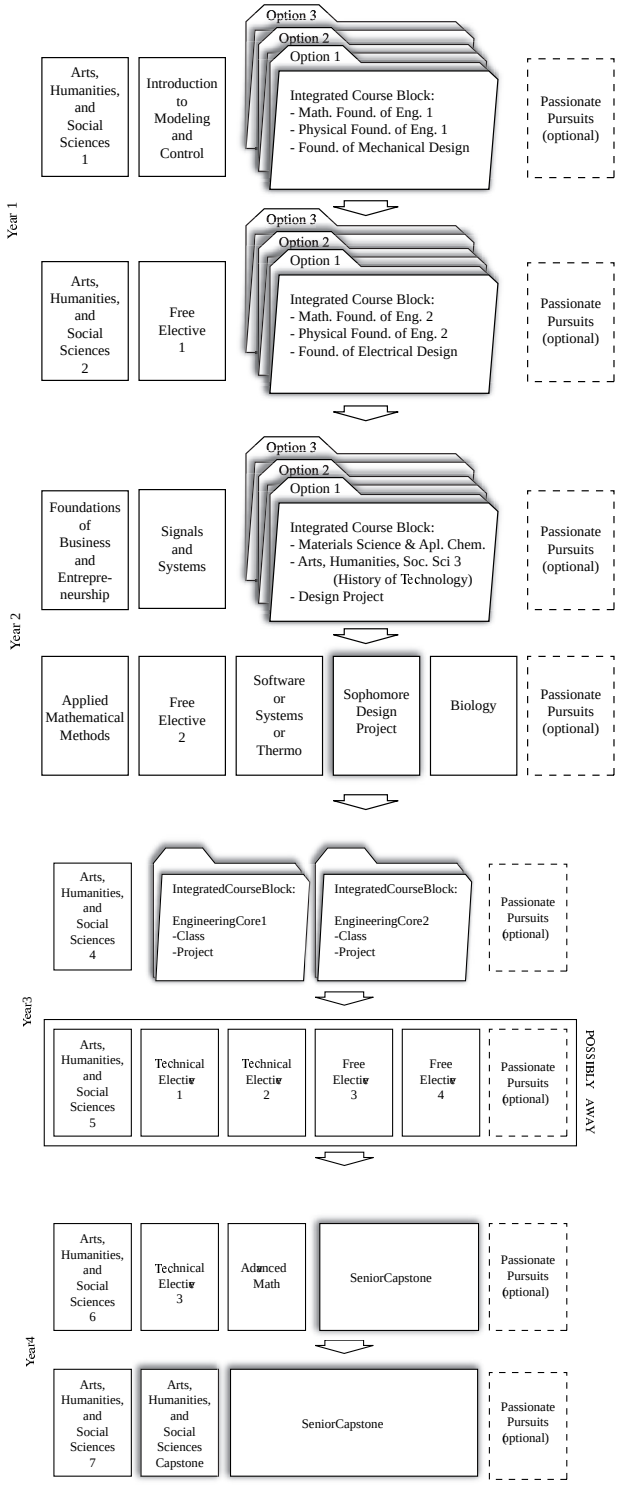

Figure 1: A sample program of study that would enable a student to satisfy all Olin degree requirements in four years while preserving the option to have a semester away, such as study abroad.

course block they choose, all students take the same set of courses by the end of the sophomore year. For example, students selecting the *Materials Science* and *History of Technology* integrated course will take *Fundamentals of Business and Entrepreneurship* and *Principles of Modern Biology* as individual courses during their Sophomore year.

In the third and fourth year of the curriculum, integrated course blocks deliver much of the core disciplinary engineering courses. As in the first two years, these integrated courses enable efficient presentation of material and allow time for design projects in order to reinforce underlying concepts.

Sophomore Design and Capstone Project

Over the course of four years, students have opportunities to complete design projects that are not specifically tied to course blocks. The *Sophomore Design Project* and senior year *Capstone Project* provide increased student independence in choosing a project topic, as well as significant occasion for in-depth research.

Planning for the *Sophomore Design Project* begins in the first semester of the sophomore year, allowing the conception of an idea considerable gestation before work begins. Project realization commences in the second semester of the sophomore year. Students apply the skills learned in three semesters of course work, illustrating technical design competence. This project course is the first opportunity for students to develop a problem's definition *and* its solution.

A student's final year at Olin centers on an ambitious year-long *Capstone Project* that involves the equivalent of five courses taken over two semesters. A typical *Capstone Project* is undertaken by a team of 3 to 6 students and includes an external partner such as a company or professor from another institution for the purposes of advising and assisting in assessment. Students spend approximately half their *Capstone Project* time engaged in advanced study and research (either self-directed or involving courses at Olin and elsewhere). The remainder of their effort is dedicated to design and building activities and the preparation of a professional paper and presentation. The *Capstone Project* prepares students for life and work in their chosen profession.

Arts, Humanities, and Social Sciences (AHS)

Olin students study the AHS in order to develop vital competencies, provide a broad context for the study of engineering, and bring Olin's graduates one step closer to the ideal of the "Renaissance engineer."

Olin students select AHS courses from offerings at Olin and neighboring institutions (Wellesley, Brandeis and Babson) in order to satisfy individual needs and interests. All students complete a set of three depth courses, investigating one AHS field at a sophisticated level, as well as two additional breadth courses providing exposure to other disciplines and perspectives. The depth and breadth experiences culminate in a student-designed *AHS Capstone* requiring students to integrate acquired skills and knowledge in an interdisciplinary project.

Students also have the option to pursue AHS topics at greater length through an Olin minor, as described below.

Entrepreneurship Across the Curriculum

Whether or not Olin College graduates pursue careers in business (or even start their own companies), an understanding of the knowledge, skills and behaviors required for success in entrepreneurship positions students to become better engineers and to make a difference in the world. To this end, Olin's curriculum supports the learning of entrepreneurship, broadly defined as "the relentless pursuit of opportunity beyond the resources you currently control" (Howard Stevenson, Harvard Business School) "for the purpose of value creation" (Stephen Spinelli, Babson College). The term "value" is broadly interpreted to include social, technical and economic value.

Olin students are required to complete a *Foundations of Business and Entrepreneurship* course as well as the entrepreneurial components of required design projects. Students also have ample opportunity to enroll in courses relating to business at Babson College. Students may count business courses as elective credit or as credit in partial fulfillment of the Olin College AHS requirements, either as the "depth" requirement (a concentration in economics) or part of the "breadth" requirement. During the spring of 2003, for example, some students have enrolled in Babson courses such as *Business Law* and *New Product Marketing*. Interested students can also design a minor in entrepreneurship.

Communication Across the Curriculum

Olin College integrates the instruction and practice of writing and speaking throughout the curriculum. Thus, it is not only within the Arts, Humanities, and Social Sciences that an Olin student can expect communication intensive course work, but within the major or field of specialization as well. Communication across the Olin

curriculum reflects the college's commitment to the engineer as both a highly skilled writer and an informed, persuasive speaker.

Study away from Olin

The Olin curriculum is designed so that students who wish to study for a semester away from the College can do so. The cost to the student of this "away experience" depends on the specific program, and this cost is not included in the Olin College scholarship. The College hopes to provide limited need-based financial aid to help students meet expenses for an away experience.

The away experience may take several forms including experience abroad or at another U.S. institution. The away experience can occur during a semester or a combination of a semester and summer. Away experiences may be planned through Olin or by individual students. To qualify for credit, an away experience plan must be approved in advance by Olin and must result in some amount of Olin College degree credit (typically between one and five course equivalents).

Students can receive transfer credit for appropriate classes taken at pre-approved institutions. Upon approval, some non-paid internships may also receive credit. This transfer and/or internship credit might count toward AHS requirements, technical electives, or free electives.

Passionate Pursuits, Independent Study, and Research

Students at Olin are encouraged to undertake non-degree credit activities in the form of Passionate Pursuits, Independent Study, and Research. These programs seek to recognize the diversity of technical, artistic, entrepreneurial, humanist, and philanthropic interests that students bring to the College. The College encourages the pursuit of such activities for both personal and professional development. Olin supports these endeavors by providing resources as well as non-degree credit. In some cases Independent Study and Research may be used to satisfy free electives credit. Procedures for initiating such activities and requesting funding are described in the Student Handbook.

Requirements of the Majors

Olin's engineering degree programs provide students with a broad, interdisciplinary technical education through an innovative blend of experiences. All engineering degree programs deliver a rigorous background in engineering with a focus on the connections among technical disciplines and an emphasis on the interrelationships of technical and non-technical concepts.

Olin is committed to broadly educating students and has structured its engineering programs to prepare students for a diversity of educational and professional directions. Olin graduates can pursue careers in a wide range of topics and many students may go on to further study and graduate degrees in science, engineering, business, medicine, or law. Olin engineering programs are designed to meet accreditation criteria outlined by the Accreditation Board for Engineering and Technology (ABET), and Olin will seek ABET recognition of all programs.

Students may pursue degrees in Mechanical Engineering (ME), Electrical and Computer Engineering (ECE), and Engineering (E). All Olin degree programs build upon the knowledge and skills developed in the foundation courses and all degree programs outline similarly demanding major-specific requirements. In addition to successful completion of the foundation material, *Sophomore Design Project*, AHS courses, and *Capstone Project* (see Graduation Requirements section), students must complete core and technical elective courses that provide sufficient depth, breadth, coherence, and rigor in an area of concentration. The major-specific requirements for these degree programs are as follows:

- Completion of 6 courses of major-specific core material.
- Completion of 3 courses of major-specific technical elective material.

Requirements for the Engineering (E) Degree

Engineering is a rigorous yet flexible degree program that is designed to meet ABET Program Criteria in Engineering while allowing students the opportunity to concentrate their studies in interdisciplinary technical areas. Under the Engineering degree students may pursue concentrations in Bioengineering (BE), Computing (C) Materials Science and Applied Chemistry (MSAC), and Systems Design (SYS). Olin students also may design their own program of study under the Engineering degree. Specific requirements of these concentration areas are outlined below.

Computing (C)

The Computing concentration combines study of computer science and software engineering within a broad

interdisciplinary context. This concentration builds on a project-based core that puts principles of computing into practice. Advanced coursework options include Computer Science as well as computational aspects of other Olin majors and concentrations.
The requirements for the Computing concentration are as follows:

Core Requirements—6 courses

- *Software Design*
- *Discrete Mathematics*
- *Foundations of Computing* (two course equivalent).
- *Design of Devices and Computation Systems* (two course equivalent).

Technical Elective Requirements—3 courses

- Three approved technical elective courses in engineering—at least two with significant computing content.

In addition to the required courses, students of Computing may choose to use free electives for further study.

Bioengineering (BE)

Bioengineering is an interdisciplinary field rooted in physics, mathematics, chemistry, and biology. The BE concentration prepares students to approach problems important to biology, medical research, and clinical studies.

The BE concentration also provides some of the depth and breadth required for students interested in attending medical school. In addition to the BE concentration requirements, use of two free electives is required to satisfy the introductory chemistry and organic chemistry pre-med requirements for most medical schools. Some medical schools also require biochemistry.

The requirements for the Bioengineering concentration are as follows:

Core Requirements—6 courses

- *Biomechanics*
- One advanced mathematics course appropriate to the concentration.
- Four courses in bioengineering (single courses or integrated two-course blocks). One course must include content in physiology and one course must include the application of engineering to medical problems.

Technical Elective Requirements—3 courses

- *Organic Chemistry*
- Two approved technical elective courses in bioengineering.

In addition to the required courses, students of Bioengineering may choose to use free electives for further study.

Materials Science and Applied Chemistry (MSAC)

Materials Science is an inherently interdisciplinary field with a strong presence throughout most engineering and science disciplines. Olin's MSAC concentration provides an integrated approach to materials systems, merging principles of engineering design with concepts from solid-state physics and chemistry. Some MSAC concentration requirements rely on course offerings within the Mechanical Engineering and Electrical and Computer Engineering programs. Students who complete the MSAC concentration will achieve an integrated understanding of structure-property-processing-performance relationships in engineering materials, the ability to apply advanced science and engineering principles to materials systems, and the knowledge to solve materials selection and design problems.

The requirements for the Materials Science and Applied Chemistry concentration are as follows:

Core Requirements—6 courses

- *Thermodynamics and Chemistry of Combustion*
- One advanced mathematics course.
- *Semiconductor Devices and Analog Integrated Circuits* (two course equivalent).
- *Design and Analysis of Mechanical Systems* (two course equivalent).

Technical Elective Requirements—3 courses

- Three approved technical elective courses, including at least one course in applied chemistry and at least one course in materials science and engineering.

In addition to the required courses, students of Materials Science and Applied Chemistry may choose to use free electives for further study in materials science or chemistry.

Systems Design (SYS)

The Systems Design concentration focuses on the design of products which integrate significant technology from multiple disciplines. For example, an inkjet

printer/scanner/fax machine utilizes technology in electrical and computer engineering, mechanical engineering, material science, chemistry, optics, software, business, and even biology. Such products are particularly hard to create because designers tend to have specialized, rather than broad, knowledge of disciplines. The SYS concentration trains students to lead multidisciplinary design teams and emerge with successful products.

The requirements for the Systems Design concentration are as follows:

Core Requirements—6 courses

- *Systems Design*
- *Design of Mechanical Systems* (two course equivalent).
- *Design of Devices and Computation Systems* (two course equivalent).
- One advanced mathematics course.

Technical Elective Requirements—3 courses

- Three approved technical elective courses in engineering with significant multi-disciplinary content.

Student-Designed Engineering Concentration

An individual student wishing to pursue a course of study within the Engineering major outside of Olin's concentration tracks may propose a specific program of study. Olin College supports the development of individual programs of study provided that they contain sufficient depth, breadth, coherence, and rigor. The program must also be sufficiently supported by the College's resources. Such a course of study must be endorsed by the student's faculty advisor or other appropriate faculty and must receive prior approval.
The general requirements for the self-designed concentration are as follows:

Core Requirements—6 courses

- Five courses (equivalent) representing the core material of the subject.
- One advanced mathematics course.

Technical Elective Requirements—3 courses

- Three approved technical electives, at least two should be related to the course of study.

Requirements for the Mechanical Engineering Degree (ME)

Mechanical Engineering is a rigorous degree program that is designed to meet ABET Program Criteria in Mechanical Engineering. The core Mechanical Engineering requirements emphasize the design of mechanical and thermal/fluid systems. Additionally, the Mechanical Engineering program has significant offerings in the areas of design and new product development that leverage offerings and expertise at Babson College.

Students may choose various technical elective courses of interest within the Mechanical Engineering degree, but all Mechanical Engineering students develop both a deep understanding of mechanical engineering and a broad appreciation of the connections between mechanical engineering and other disciplines.

The requirements for the Mechanical Engineering degree are as follows:

Core Requirements—6 courses

- *Thermodynamics and Chemistry of Combustion*
- *Partial Differential Equations*
- *Design of Mechanical Systems* (two course equivalent).
- *Design of Thermal/Fluid Systems* (two course equivalent).

Technical Elective Requirements—3 courses

- Three approved technical elective courses in engineering.

Requirements for the Electrical and Computer Engineering Degree (ECE)

Electrical and Computer Engineering is a rigorous degree program that is designed to meet ABET Program Criteria in electrical and computer engineering. Olin's Electrical and Computer Engineering degree focuses on the devices and structure of computing and communications systems, with an emphasis on hardware design.

Students may choose various technical elective courses of interest within the Electrical and Computer Engineering degree, but all Electrical and Computer Engineering students will develop both a deep understanding of electrical and computer engineering and a broad appreciation of the connections between electrical and computer engineering and other disciplines.

The requirements for the Electrical and Computer Engineering degree are as follows:

Core Requirements—6 courses

- *Software Design*
- *Discrete Math*
- *Design of Devices and Computation Systems* (two course equivalent).
- *Design of Information and Communications Systems* (two course equivalent).

Technical Elective Requirements—3 courses

- Three approved technical elective courses in engineering.

Arts, Humanities, and Social Sciences (AHS) Requirements

Olin students must complete at least eight AHS courses prior to graduation and must take at least one AHS course each year. These eight courses must follow the following distribution:

- *One foundation course.* Olin students must take one designated "AHS foundation" course in their first year, ideally in their first semester. The foundation course is an introductory AHS experience that offers opportunities for the development of communication and critical thinking skills, and the introduction of readings and topics from more than one AHS field. Current foundation course options include honors sections of two Babson courses (Arts and Humanities Foundation and History and Society Foundation) as well as the Olin offerings such as History of Technology Foundation.
- *Three depth courses.* All Olin students must complete an approved sequence of at least three courses in a single AHS field, for example, history or music or art. These three courses must build upon each other and enable advanced study Students must concentrate in an area of intellectual inquiry, and not in a purely skill-based field. The foundation and capstone courses do not count toward the depth requirement.
- *Two breadth courses.* All Olin students must sample at least three separate AHS disciplines, thereby achieving a "breadth" of coverage. One of these disciplines is represented in the depth requirement discussed above: students must take two additional AHS courses in different fields. While an "ideal" breadth selection would include one course offering from the arts, one from the humanities, and one from the social sciences, this is not a requirement. The foundation and capstone courses do not count toward the breadth requirement.
- *One AHS Capstone.* All Olin students must complete an *AHS Capstone* activity in their fourth year. The *AHS Capstone* can be linked to the engineering capstone or can be taken as a stand-alone activity. The capstone requires the integration of at least two AHS disciplines through a semester-long, student-initiated project. This project should include "real-world" objectives such as art, philanthropy, entrepreneurship, music, performance, composition, or publication.
- *One unrestricted AHS course.*

Entrepreneurship Requirements

All Olin students must complete the *Foundations of Business and Entrepreneurship* course in their second year. Students will also learn and apply principles of entrepreneurship through many of their required project courses. During the first year curriculum, for example, students learn about opportunity generation and assessment as part of their foundation design project classes.

Students can explore entrepreneurial topics in further detail through Olin's AHS requirements and minor program.

Requirements for a Minor

A minor is defined as an approved group of six courses that provides depth in a particular field or topic. Minors may be pursued in areas outside the major degree program. Pursuit of a minor may enhance a students educational experience by providing more coherence and focus in choosing elective courses.

Guidelines for Minors are as follows:

- Minors are optional; no group of faculty is required to offer a minor, and no student is required to pursue a minor.
- Students in any engineering major may pursue a minor.
- Minors are approved by the Academic Recommendations Board.
- A maximum of four courses may be "double-counted" toward both the minor requirements and other Olin requirements (such as AHS or major requirements).

- Approved courses from other institutions may count toward the minor requirements.
- Approved undergraduate research and independent study for degree credit may count toward the minor requirements.
- Students pursuing a minor are encouraged to include significant minor-specific content in their *Capstone Project* and/or *AHS capstone*.

Cross Registration at Babson, Wellesley, and Brandeis

Olin College is developing cooperative agreements with Babson College, Wellesley College and Brandeis University to allow students to take courses at these other institutions, and *vice versa*. These agreements (in place with Babson and Wellesley, pending with Brandeis) will have some restrictions:

- Each institution reserves the right to limit enrollment in its classes.
- Logistical constraints (transportation time and schedule conflicts) may limit participation in courses on other campuses.
- Certain requirements, such as foundation courses, must be taken at Olin.

In the spring of 2003, 36 of Olin's 75 students took one or more of their classes at Babson or Wellesley.

Plans for Accreditation

Olin's curriculum provides the depth, breadth, cohesion and rigor necessary to produce fully qualified engineering graduates. The three major degree programs (Mechanical Engineering, Electrical and Computer Engineering, and Engineering) have been designed to meet the General Criteria outlined by the Accreditation Board for Engineering and Technology (ABET). In addition, Olin's Mechanical Engineering and Electrical and Computer Engineering degree programs have been designed to meet ABET Program Criteria for these areas.

Although the Accreditation Board for Engineering and Technology (ABET) does not accredit programs until degrees are conferred, accreditation status is extremely important to Olin College. As such, Olin plans to request formal ABET evaluation as soon as possible after graduation of the Class of 2006.

At the institutional level, Olin's curriculum has been designed to conform to the requirements of the New England Association of Schools and College (NEASC), Commission on Higher Education, the pertinent regional accreditation body. As with ABET, a full accreditation review cannot take place until after Olin's first class has graduated. However, Olin plans to undergo a preliminary review with NEASC for "Candidacy" status during the next academic year. Candidacy establishes a formal relationship with NEASC and indicates that we are progressing toward accreditation.

When accreditation is granted by ABET or NEASC, it becomes retroactive, applying to degrees conferred in previous years.