Cornell Engineering

ENGINEERING UNDERGRADUATE HANDBOOK

Fall 2016

Name:_____

Campus Address:_____

Phone: _____

E-mail: _____

College of Engineering
Cornell University
ABET Accredited Programs for 2016–17

ABET is recognized by the Council for Higher Education Accreditation (CHEA) as the organization responsible for the accreditation of educational programs leading to degrees in engineering, engineering technology, computing, and applied science.

The following undergraduate-degree programs (majors) are accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

Biological Engineering
Chemical Engineering
Civil Engineering
Electrical and Computer Engineering
Environmental Engineering
Materials Science and Engineering
Mechanical Engineering

Preface

This handbook is intended to support you as an entering and continuing undergraduate in the College of Engineering at Cornell University. (Some curriculum requirements may not be relevant to continuing students.) It has been prepared as a reference guide to the requirements, programs, policies, and procedures of the college. We hope that you will find the information you need for both planning and understanding your engineering education.

The College of Engineering would also like to emphasize the importance of the social and ethical implications of the work of engineers as a contribution to the improvement of society. You are fortunate to be a part of an educational community composed of people from many different parts of the world and from diverse identity groups in the United States. This diversity gives Cornell a rich multicultural character, and living in the Cornell community can be an opportunity to learn respect for the customs of others and to experience cultural pluralism in today's world. We encourage you to seek out and explore courses and activities that address issues of diversity and inclusion to gain a more valuable educational experience, become more culturally competent, and to prepare for the practice of engineering.

Although this handbook serves as a guide for the development of an undergraduate engineering education, it does not constitute a complete or definitive statement of the policies of Cornell University and the College of Engineering. The university announcement *Courses of Study* is the official document of the university for defining academic programs and requirements. In addition, the final authority for academic degree requirements of the College of Engineering is jointly administered by the faculty of the College of Engineering, the College Curriculum Governing Board, and the faculty of the individual Majors within Engineering. For more complete information, consult the sources mentioned in this handbook, *Courses of Study*, and Engineering Advising in 167 Olin Hall.

We hope you find this handbook a useful resource as you progress through your years at Cornell. We wish you much success.

Liane Fitzgerald
Director, Engineering Advising

Melissa Bazley
Associate Director, Engineering Advising

Megan Gallagher
Assistant Director, Engineering Advising

Mary Glick
Publications and Program Coordinator

Responsibility for Meeting Degree Requirements

Ultimately, students are responsible for understanding the degree requirements for their Majors and for planning their courses of study accordingly. They should consult the appropriate undergraduate office (listed on pages 10–11) for more specific information. The Major will provide a consultant who can answer specific questions and make binding decisions relating to the fulfillment of degree requirements. Faculty advisors will assist in course selection, but they are not responsible for ensuring that the courses selected meet degree requirements. That is the responsibility of the student.

Contents

University and College Mission, Vision, and Values

Cornell University's Mission and Values

"I would found an institution where any person can find instruction in any study."
Ezra Cornell, 1868

Cornell is a learning community that seeks to serve society by educating the leaders of tomorrow and extending the frontiers of knowledge.

In keeping with the founding vision of Ezra Cornell, our community fosters personal discovery and growth, nurtures scholarship and creativity across a broad range of common knowledge, and engages men and women from every segment of society in this quest. We pursue understanding beyond the limitations of existing knowledge, ideology, and disciplinary structure. We affirm the value to individuals and society of cultivation and enrichment of the human mind and spirit.

Our faculty, students, alumni, and staff strive toward these objectives in a context of freedom with responsibility. We foster initiative, integrity, and excellence, in an environment of collegiality, civility, and responsible stewardship. As the land-grant university for the state of New York, we apply the results of our endeavors in service to our alumni, the community, the state, the nation, and the world.

College of Engineering Undergraduate Programs Mission

The College of Engineering is dedicated to the transformation of its excellence in research and design to a correspondingly outstanding educational experience in engineering and applied science for a diverse group of baccalaureate students.

Specific missions are to:

- enroll and graduate a highly qualified and diverse undergraduate student body and enable their success.
- continuously improve the quality of the undergraduate education by ongoing evaluation of the common curriculum, assessment of teaching and learning, and implementation of improvements to the program based on those results.
- infuse the results of ongoing research, the capabilities of technology, the excitement of hands-on learning, and the experience of design projects into the undergraduate curricula.
- provide high-quality information and guidance to undergraduate students about the college, about curricula, and about future employment possibilities.
- oversee the educational progress of all students and encourage and enhance their success, both prior to affiliation with a Major and within the Major.
- collaborate with the faculty and administration of other Cornell colleges and organizations external to Cornell to efficiently provide the best possible undergraduate education.

Vision

Cornell Engineering will utilize the world-class intellectual resources and interdisciplinary opportunities of the college and university to prepare its undergraduate students for lifelong creation of knowledge and solutions to complex real-world problems.

Values

We believe that all students who enroll in the engineering college undergraduate program are capable of successfully graduating with a B.S. degree. We understand that young people in the typical undergraduate age range are maturing rapidly and therefore may change their professional and personal aspirations and may struggle with adjustments to campus life and academic expectations. It is our responsibility to maintain a curricular schedule that allows students to change directions and services to assist them in making informed decisions. We respect the variability of learning styles spanned by our students and faculty. We embrace the responsibilities of Cornell faculty members for preeminent research as well as for excellent undergraduate education. Furthermore, we highly value the need of everyone in our college community to balance workload and personal life. We prize an inclusive, respectful college environment in which community bonds and community responsibility exceed competitiveness.

Educational Objectives

College of Engineering graduates will demonstrate early in their careers an ability to:

- apply their general educational experience and specific knowledge of mathematics, science, and engineering to a wide variety of careers including industry, advanced engineering study, nontraditional engineering-related career paths, and graduate study.
- perform in a modern diverse working environment in which they will work in multidisciplinary teams and communicate effectively with both professional colleagues and the public.
- lead design processes that include consideration of the impact designs have on people, societies, and nature.
- model, analyze, and solve complex problems from a systems perspective.
- recognize contemporary global issues and their professional and ethical responsibility to contribute to solutions for the social, economic, and environmental challenges faced by humanity.
- engage in self-directed learning, including the pursuit of graduate study and professional development activities.

Student Learning Outcomes

In terms of their general abilities, our graduates will

1. Have a broad education, including liberal studies.
2. Be proficient in oral and written communication.
3. Be proficient in information literacy, i.e. be able to locate, evaluate, and effectively interpret claims, theories, and assumptions in science and engineering.
4. Have experience with teamwork.
5. Be aware of professional and ethical responsibilities.

In terms of their discipline, students will be well grounded in the mathematical, scientific, and engineering skills that are the basis of their discipline. More specifically, our graduates will have:

1. The ability to design experiments, analyze the data, and interpret the results.
2. The ability to design, model, and analyze engineering systems.
3. The ability to formulate and solve problems.
4. The ability to use the techniques and tools necessary for the practice of their discipline.

Guide to Important Resources*

*All phone numbers begin with a 607 area code.

College of Engineering

Office of the Dean, 242 Carpenter Hall, 255.4326

Associate Dean for Undergraduate Programs, 167 Olin Hall, 255.8240

Assistant Dean for Student Services, 167 Olin Hall, 255.8240

Cornell Engineering Career Center, 201 Carpenter Hall, 255.5006

Cooperative Education Program, 201 Carpenter Hall, 255.5006

Diversity Programs in Engineering, 146 Olin Hall, 255.6403

Engineering Advising, 167 Olin Hall, 255.7414

Engineering Admissions, 102 Hollister Hall, 255.5008

Engineering Communications Program, 465 Hollister Hall, 255.7199

Engineering Leadership Program, 156 Olin Hall, 255.9074

Engineering Learning Initiatives, 167 Olin Hall, 255.9622

Engineering Library, Carpenter Hall, 254.6261

Engineering Registrar, 158 Olin Hall, 255.7140

Engineering Student Project Teams, B27 Upson Hall, 255.1380

Personal Counseling Services

Cornell United Religious Work, Anabel Taylor Hall, 255.4214

Counseling and Psychological Services, level three, Gannett Health Services, 255.5208

EARS (Empathy, Assistance, and Referral Service), 213 Willard Straight Hall, 255.EARS

Let's Talk Walk-in Service, for hours/locations: www.gannett.cornell.edu/services/counseling/caps/talk/index.cfm

Suicide Prevention and Crisis Service, Ithaca, NY 14850, 272.1616 (24 hrs.)

Academic Support and Tutorial Services

Diversity Programs in Engineering, 146 Olin Hall, 255.6403
Engineering Advising, 167 Olin Hall, 255.7414
Engineering Learning Initiatives, 167 Olin Hall, 255.9622
Learning Strategies Center, 420 Computing and Communications Center, 255.6310
Mathematics Support Center, 256 Malott Hall, 255.3905
Office of Undergraduate Biology, 216 Stimson Hall, 255.5233
Physics Tutoring, 115 Rockefeller Hall, 255.6310
Student Disability Services, 4th floor, Computing and Communications Center, Rm 420, 254.4545
Writing Workshop, 174 Rockefeller Hall, 255.6349

Career and Professional Development Services

Cornell Career Services, 103 Barnes Hall, 255.5221
Cornell Engineering Career Center, 201 Carpenter Hall, 255.5006
Engineering Cooperative Education Program, 201 Carpenter Hall, 255.5006
Engineering Leadership Program, 156 Olin Hall, 255.9074
Engineering Research and Graduate Studies, 223 Carpenter Hall, 255.0976

Other Resources

Bursar's Office, 260 Day Hall, 255.6413, or 255-2336 (student accounts)
Campus Life Management, 2336 South Balch Hall, 255.5511
Continuing Education and Summer Sessions, B20 Day Hall, 255.4987
Dean of Students Office, 401 Willard Straight Hall, 255.6839
Department of Inclusion and Workforce Diversity, 150 Day Hall, 255.3976
Financial Aid and Student Employment, 203 Day Hall, 255.5145
Gannett Health Center, Gannett Health Services, 255.5155
Housing and Dining Office, 206 Robert Purcell Community Center, 255.5368
International Students and Scholars Office, B50 Caldwell Hall, 255.5243
Judicial Administrator, 120 Day Hall, 255.4680
Office of Academic Diversity Initiatives, 200 CCC Building, 255.3841
Office of Internal Transfer and Concurrent Degrees, 200 CCC Building, 255.4386
Ombudsman, 118 Stimson Hall, 255.4321
Student Disability Services, Rm 420, CCC Building, 254.4545
University Registrar, B7 Day Hall, 255.4232
Willard Straight Ambassadors, 401 Willard Straight Hall, 255.6839

Associate Directors/Directors of Undergraduate Studies, and Major Coordinators

A faculty member serves as Associate Director (AD) or Director of Undergraduate Studies (DUS) of each Engineering Major. An AD/DUS can be a valuable source of information for students who want to learn more about their respective undergraduate Majors.

Biological Engineering (BE)

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Chemical Engineering (ChemE)

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Civil Engineering (CE)

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Emily Ivory
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Operations Research and Engineering (ORE)

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282 Rhodes Hall, 255-9131

Cindy Jay
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James Renegar
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Science of Earth Systems (SES)

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3120 Snee Hall

Savannah Williams
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2124 Snee Hall, 255.5466

Requirements for the Bachelor of Science Degree

Category	Credits
1. Mathematics	14–16
MATH 1910, 1920, 2930 or 2940, and a mathematics course chosen by the Major.	
2. Physics	8–12
PHYS 1112 and 2213, and, depending on the Major, either PHYS 2214 or a designated mathematics or science course.	
3. Chemistry	4–8
CHEM 2090. Majors in ChemE or those planning on a health-related career should take CHEM 2090 and then 2080. Students in Environmental Engineering should take CHEM 2090 and CHEM 1570/3570. SES Majors should take CHEM 2090 and then 2080/1570.	
4. First-year writing seminars (two courses)	6
5. Computing (CS 1110, 1112, 1114, or 1115)	4
6. Engineering distribution	
a. one introduction to engineering (ENGRI) course	3
b. two distribution courses (ENGRD), one of which may be required by the Major	6–8
7. Liberal studies distribution (six courses)	≥18
8. Advisor-approved electives	6
9. Major program	
a. Major-required courses	≥30
b. Major-approved electives	9
c. courses outside the Major	9

10. In addition to the first-year writing seminars, a technical writing course must be taken as an engineering distribution, liberal studies, Advisor-approved elective, or Major course.

11. Two semesters of physical education and demonstration of proficiency in swimming (university requirement).

The total number of credits required for graduation vary by Major. Specific requirements for each Major are given on the following pages.

The Academic Program

College of Engineering Majors

In the first two years, students in the College of Engineering take courses designed to provide a firm foundation for later specialization. These courses conform to the Common Curriculum, which is established by the College Curriculum Governing Board (CCGB) and administered through Engineering Advising. During the second year, students affiliate with an undergraduate Major (see list below); thereafter, they take courses to satisfy the Bachelor of Science degree in that Major.

Biological Engineering (BE)

Biomedical Engineering (BME)

Chemical Engineering (ChemE)

Civil Engineering (CE)

Computer Science (CS)

Electrical and Computer Engineering (ECE)

Engineering Physics (EP)

Environmental Engineering (EnvE)

Independent Major (IM)

Information Science, Systems, and Technology (ISST)

Materials Science and Engineering (MSE)

Mechanical Engineering (ME)

Operations Research and Engineering (ORE)

Science of Earth Systems (SES)

Requirements for Graduation

The detailed requirements of the Common Curriculum appear in the university announcement *Courses of Study*, which is revised annually. Students should become familiar with this material, because they are ultimately responsible for meeting all graduation requirements.

The Common Curriculum and the Bachelor of Science degree require a certain number of credits in courses belonging to 10 categories.

Category 1. Mathematics

Students must earn at least C– in MATH 1910, 1920, 2930 or 2940, and a math course chosen by the Major. Students who do not meet this requirement the first time are expected to immediately repeat the course and earn a satisfactory grade. Students should not enroll in the next course in the sequence until they have done so. (A grade lower than C– the second time will result in withdrawal from the engineering program.) Courses taken a second time to meet this requirement do not yield additional credit toward a degree.

Category 2. Physics

Students are expected to have credit for MATH 1910 before taking PHYS 1112. Similarly, at least C– is required in each subsequent math course before taking the physics course for which it is a prerequisite (MATH 1920 is a prerequisite for PHYS 2213; MATH 2930 is a prerequisite or co-requisite for PHYS 2214).

Category 3. Chemistry

Students requiring the CHEM 2090–2080 sequence (most often students pursuing ChemE or prehealth) must enroll in CHEM 2090 during the fall semester of the first year so that they may enroll in CHEM 2080 during the spring. Students who do not intend further study in chemistry should enroll in CHEM 2090 during either semester of the first year.

Category 4. Computing

Students should enroll in Introduction to Computing (one of CS 1110, 1112, 1114, or 1115) during either semester of the first year.

Before CS 111x, some students take CS 1109: Fundamental Programming Concepts, offered only in the summer. CS 1109 may not be used as credit toward graduation.

Category 5. First-Year Writing Seminars

During each semester of the first year, students must choose a first-year writing seminar from among more than 100 courses offered by more than 30 different departments throughout Cornell. These courses, which offer the benefits of small class size, provide an opportunity to practice writing English prose.

Category 6. Technical Writing

In addition to the first-year writing seminars, a technical writing course must be taken as an engineering distribution, liberal studies, Advisor-approved elective, or Major course. All credit-bearing options for fulfilling the requirement (whether they also fulfill a LS requirement or not) must be taken for a grade. Students can petition to the technical writing subcommittee special projects that are not graded, but that is the only exception.

Students can fulfill the upper-level technical-writing requirement in one of the six ways shown below. For more information, see www.engineering.cornell.edu/ECP/. (Note: Courses designated with an asterisk are

1. ENGRC 3340, ENGRC 3350, ENGRC 3500, taught by the Engineering Communications Program.
2. The Writing-Intensive Co-op, an opportunity to combine work and academics. Some co-op students do a significant amount of writing on the job, and, under certain circumstances, this writing may satisfy the college's technical-writing requirement.
3. An officially designated writing-intensive (W-I) engineering course. The following list represents engineering courses which currently meet the W-I designation, and is subject to change. Students should confirm with their major department that a course still satisfies the technical writing requirement prior to enrollment. (Please note: It is mandatory that courses marked with an asterisk [*] be taken with their corresponding one-credit ENGRC component.)

   *AEP/ENGRD 2640: Interfacing the Digital Domain with an Analog World

   *BEE/MAE 4530: Computer-Aided Engineering: Applications to Biomedical Processes

BEE 4590: Biosensors and Bioanalytical Techniques

BEE 4730: Watershed Engineering

*BEE 4890: Entrepreneurial Management for Engineers

CHEME 4320: Chemical Engineering Laboratory

*CS/INFO 3152: Introduction to Computer Game Architecture

*CS/INFO 4152: Advanced Topics in Computer Game Design

INFO 1200: Information Ethics, Law, and Policy

MAE 4272: Fluids/Heat Transfer Laboratory

MSE 4030/4040 (both): Senior Materials Laboratory I and II

MSE 4050/4060 (both): Senior Thesis I and II

4. ENGRC 3023, a 1-credit attachment to an engineering course that is not one of the officially designated W-I courses (see #3 above). An instructor may wish to extend the writing done in their course for a given semester so that it will fulfill the technical-writing requirement. With the approval of the CCGB's Subcommittee on Technical Writing, the instructor may have students co-register in ENGRC 3023. (May be taken more than once, with different courses, by permission of engineering instructor.)
5. COMM 3020: Science Writing for the Media, or COMM 3030: Organizational Writing, taught by the Department of Communication (in the College of Agriculture and Life Sciences).
6. Petition. Occasionally, students will be doing a significant amount and variety of technical writing elsewhere in engineering. It may be appropriate to submit a petition to the CCGB's Subcommittee on Technical Writing for permission to use their upcoming writing (not past writing) to meet the technical-writing requirement.

Category 7. Engineering Distribution

The Common Curriculum requires three distribution courses (9 credits). One intro-to-engineering course (with the course acronym ENGRI) is to be completed during the first year. The remaining two distribution courses (with the course acronym ENGRD) should be completed by the end of the fourth semester. Some Majors may require additional distribution courses, taken after a student affiliates with a Major. Common Curriculum distribution requirements must be fulfilled by the end of the second year.

The intro-to-engineering course introduces students to the engineering process and provides a substantive experience in open-ended problem-solving. The following courses fulfill this requirement (For the most current listing, see Courses of Study: www.courses.cornell.edu):

ENGRI 1100: Lasers and Photonics

ENGRI 1101: Engineering Applications of Operations Research

ENGRI 1110: Nanotechnology for Global Health and a Sustainable World

ENGRI 1120: Introduction to Chemical Engineering

ENGRI 1130: Sustainable Design for Appledore Island

ENGRI 1140: Materials: The Future of Energy

ENGRI 1160: Modern Structures

ENGRI 1170: Introduction to Mechanical Engineering

ENGRI 1190: Biomaterials for the Skeletal System

ENGRI 1200: Introduction to Nanoscience and Nanoengineering

ENGRI 1220: Earthquake!

ENGRI 1270: Introduction to Entrepreneurship and Enterprise Engineering

ENGRI 1310: Introduction to Biomedical Engineering

ENGRI 1610: Computing in the Arts

ENGRI 1620: Visual Imaging in the Electronic Age

ENGRI 1820: Electricity Lights Camera Action: Nanoengineering for the Future of Bits and Bytes

Students who do not take an ENGRI course may substitute an ENGRD course for the ENGRI requirement. The ENGRD course must not be used for other common curriculum or major requirements and must represent a third ENGRD category.

The two ENGRD courses (6–8 credits) must be selected from two different categories listed below. A student may use any one of the possible substitutions described.

1. Scientific Computing

ENGRD 2110: Object-Oriented Programming and Data Structures

ENGRD 2112: Object-Oriented Design and Data Structures–Honors

ENGRD 3200: Engineering Computation

2. Materials Science

ENGRD 2610: Mechanical Properties of Materials; From Nanodevices to Superstructures

ENGRD 2620: Electronic Materials for the Information Age

3. Mechanics

ENGRD 2020: Statics and Mechanics of Solids

Majors in Engineering Physics may use AEP 3330: Mechanics of Particles and Solid Bodies as an ENGRD in this category.

4. Probability and Statistics

ENGRD 2700: Basic Engineering Probability and Statistics

Majors in Engineering Physics may substitute MATH 4710: Basic Probability for ENGRD 2700. Majors in Civil, Biological, or Environmental Engineering may substitute CEE 3040: Uncertainty Analysis in Engineering for ENGRD 2700.

ENGRD 3100: Introduction to Probability and Inference for Random Signals and Systems

5. Electrical Sciences

ENGRD 2100: Introduction to Circuits for Electrical and Computer Engineers

ENGRD 2200: Signals and Information

ENGRD 2300: Digital Logic and Computer Organization

ENGRD 2640: Interfacing the Digital Domain with an Analog World

6. Thermodynamics and Energy Balances

ENGRD 2190: Mass and Energy Balances

ENGRD 2210: Thermodynamics

7. Earth and Life Sciences

ENGRD 2250: The Earth System

ENGRD 2510: Engineering Processes for Environmental Sustainability

ENGRD 2600: Principles of Biological Engineering

8. Biology and Chemistry

BIOMG 3300, 3310, 3330, or 3350: Principles of Biochemistry

CHEM 3890: Honors Physical Chemistry I

ENGRD 2202: Biomedical Transport Phenomena

ENGRD 2520: The Physics of Life

Category 8. Liberal Studies Distribution

Global and diverse societies require that engineers have an awareness of historical patterns, an appreciation for different cultures, professional ethics, the ability to work in multifaceted groups, and superior communication skills. Cornell has a rich curriculum in the humanities, arts, and social sciences, enabling every engineering student to obtain a truly liberal education. At least six courses (totaling at least 18 credits) are required, and these should be chosen with as much care and foresight as courses from technical areas.

- The six courses must be chosen from at least three of the following seven groups
- No more than two courses may be chosen from Group 7 (CE).
- At least two courses must be at the 2000 level or higher.

Students should utilize the current *Courses of Study* as the master list of approved liberal studies courses. Refer to the web page of Cornell Engineering Advising (www.engineering.cornell.edu/apps/liberalstudies/index.html), for complete lists of additional approved courses and unacceptable courses. Please direct any questions to Engineering Advising, 167 Olin Hall.

Group 1. Cultural Analysis (CA)

Courses in this area study human life in particular cultural contexts through interpretive analysis of individual behavior, discourse, and social practice. Topics include belief systems (science, medicine, and religion); expressive arts and symbolic behavior (visual arts,

performance, poetry, myth, narrative, and ritual); identity (nationality, race, ethnicity, gender, and sexuality); social groups and institutions (family, market, and community); and power and politics (states, colonialism, and inequality).

Group 2. Historical Analysis (HA)

Courses in this area interpret continuities and changes—political, social, economic, diplomatic, religious, intellectual, artistic, and scientific—through time. The focus may be on groups of people, a specific country or region, an event, a process, or a time period.

Group 3. Literature and the Arts (LA)

Courses in this area explore literature and the arts in two different but related ways. Some courses focus on the critical study of art works and on their history, aesthetics, and theory. These courses develop skills of reading, observing, and hearing and encourage reflection on such experiences; many investigate the interplay among individual achievement, artistic tradition, and historical context. Other courses are devoted to the production and performance of art works (in creative writing, performing arts, and media such as film and video). These courses emphasize the interaction among technical mastery, cognitive knowledge, and creative imagination.

Group 4. Knowledge, Cognition, and Moral Reasoning (KCM)

Courses in this area investigate the bases of human knowledge in its broadest sense, ranging from cognitive faculties (such as perception) shared by humans and animals, to abstract reasoning, to the ability to form and justify moral judgments. Courses investigating the sources, structure, and limits of cognition may use the methodologies of science, cognitive psychology, linguistics, or philosophy. Courses focusing on moral reasoning explore ways of reflecting on ethical questions that concern the nature of justice, the good life, or human values in general.

Group 5. Social and Behavioral Analysis (SBA)

Courses in this area examine human life in its social context through the use of social-scientific methods, often including hypothesis testing, scientific sampling techniques, and statistical analysis. Topics studied range from the thoughts, feelings, beliefs, and attitudes of individuals to interpersonal relations between individuals (e.g. in friendship, love, conflict), to larger social organizations (e.g. the family, society, religious or educational or civic institutions, the economy, government), to the relationships and conflicts among groups or individuals (e.g. discrimination, inequality, prejudice, stigmas, conflict resolution).

Group 6. Foreign Languages (not literature courses) (FL)

Courses in this area teach language skills, including reading, writing, listening, and spoken non-English languages, at beginning to advanced levels.

Group 7. Communications in Engineering (CE)

Courses in this area explore communication as a way of acting in the world. The primary aim is to provide students with the opportunity to practice performing a range of engineering-related communication skills within specific genres (e.g. proposals, reports, and

journal articles, oral presentations, etc.). Each of these genres potentially engages a wide variety of audiences and, depending on the particulars of context, each may have multiple purposes. The secondary aim is to enable students to be aware of the choices they make as communicators and to be able to articulate a rationale for those choices. (No more than two courses in this category may be used to satisfy the liberal studies requirement.)

Category 9. Advisor-approved Electives

Six credits of electives are required and must be approved by the student's faculty advisor. (All students are strongly encouraged to officially document Advisor-approved electives by completing a petition, available in Engineering Advising, 167 Olin Hall.) Because these courses should help develop and broaden the skills of the engineer, advisors will generally accept the following as Advisor-approved electives: one introduction to engineering course, engineering distribution courses, courses stressing oral or written communication, upper-level engineering courses, advanced courses in mathematics, and rigorous courses in the biological and physical sciences. Advisors are likely to approve courses in business, economics, and language that serve the student's educational and academic objectives. In other cases, a student's interests might be better served by Advisor-approved electives that expand the Major or other parts of the curriculum, including the liberal studies requirement. (Note: Up to 6 credits of Advisor-approved electives will be allowed for ROTC courses at or above the 3000 level.) In the event a student and their faculty advisor disagree regarding the suitability of an Advisor-approved elective, the student may appeal the decision to the Director of Undergraduate Studies (Associate Director) for their Major department or to the Associate Dean for Undergraduate Programs.

Students are free to take as many courses as they wish, in addition to the minimum engineering curriculum requirement, before meeting graduation requirements.

No course with a number <1100 can be applied toward graduation requirements.

Category 10. Major Requirements

The requirements of the Majors are discussed on pages 31–87. They include:

1. Major-required courses
2. Major-approved electives
3. Courses outside the Major

Residence Requirements

Candidates for an undergraduate degree in Engineering must spend at least four semesters or an equivalent period of instruction as full-time students at Cornell, including at least three semesters affiliated with an Engineering Major.

Engineering students who are on a leave of absence may not enroll in courses at Cornell. Exceptions are granted in extraordinary circumstances with permission from Engineering Advising. At most, 18 credits earned through extramural study (during a fall or spring semester) or acquired as transfer credit (or any combination thereof) following matriculation may be used to satisfy the requirements for the bachelor's degree in Engineering. (Credit for summer or winter session courses taken at Cornell is not considered transfer credit, nor does it count toward the 18-credit maximum.) Students cannot complete their last semester extramurally.

Degree candidates may spend periods of time studying away from the Cornell campus with appropriate authorization. Information on programs sponsored by other universities and on procedures for direct enrollment in international universities is available at the Cornell Abroad office, 300 Caldwell Hall. Programs should be planned in consultation with the staff of Engineering Advising. For study abroad, see also page 124.

First-Year Requirements

By the end of the first year, engineering students are expected to have completed (or received credit for) the following core requirements:

- MATH 1910 and MATH 1920;
- Two of the following (depending on Major): CHEM 2090, CHEM 2080, PHYS 1112, 2213, 2214;
- One of CS 1110, CS 1112, CS 1114, or CS 1115;
- Two first-year writing seminars;
- One intro-to-engineering course (ENGRI designation);
- Two physical education courses and the university swim test.

Students interested in Chemical Engineering or pre-health study should enroll in the CHEM 2090-CHEM 2080 sequence during their first year.

Students interested in Biomedical Engineering should additionally complete BIOG 1440 or BIOMG 1350, and BIOG 1500 during their first year. (AP Biology credit is not accepted.)

Preparing for a Major

Most Majors begin with courses that cannot be taken without completion of certain prerequisites. Students planning to affiliate with such a Major must decide to do so early enough to take the prerequisite courses, even though they will not formally affiliate until after the prerequisites have been completed. Information on prerequisites of each Major is available on pages 28-30 of this handbook and in *Courses of Study*.

Academic Advising - Roles and Responsibilities

A variety of resources for academic advising and support are available to undergraduate students in the College of Engineering. Students are assigned a faculty advisor when they begin their course of study in the College of Engineering. Students usually keep this advisor until they affiliate with a Major, even though the advisor may not be in the Major in which they intend to affiliate. Once students are accepted to a Major, they are assigned a faculty advisor from that Major. Throughout their undergraduate career students can access supplemental advising and support through Engineering Advising and Major Coordinators within each Major Department.

Student Responsibilities

- *Initiate Contact.* Students are expected to initiate contact with their faculty advisors for scheduling, course changes, and other matters in a timely fashion. Because of teaching commitments, research, and travel obligations, advisors may not be available on short notice. Students are expected to plan ahead and initiate contact with their advisors well in advance of specific deadlines. Students should be prepared for each meeting;
- *Follow through with Referrals*. Students are expected to follow through with referrals to other programs and support services;
- *Keep Advisors Informed.* Advisors can provide better advice if they are kept informed of their advisees' academic progress, challenges and career goals;
- *Work to Develop Rapport.* The rapport necessary to good advising can occur only if both advisor and student make an active effort to develop it. Recognizing that individual advisors have their own styles and personalities, students should make efforts to get to know their faculty advisors and respond to the efforts of their advisors to get to know them and their academic interests.

Faculty Advisors

Faculty advisors help students translate their academic interests into an appropriate course of study, offering general guidance related to academic majors, internships, graduate study, and career planning.

Faculty advisor responsibilities include:

- Meeting with individual students (office hours/appointments) to provide guidance related to college and major curriculum requirements;
- Advising students on substitutions for required courses, and on the process for gaining approval for any deviation from curricular requirements;
- Providing guidance on College and University resources supporting students' goals and challenges, e.g., Engineering Advising, Engineering Learning Initiatives, Diversity Programs in Engineering, Counseling and Psychological Services.

What to expect from your faculty advisor:

- *Advice.* Students should use their faculty advisor as a resource for planning their

academic program, identifying academic and career goals, and general advice on graduate degrees and careers in engineering and science;

- *Assistance and Referrals.* Faculty advisors may provide general information about and referrals to special programs including Engineering Co-Op and Career Services, Engineering Learning Initiatives, study abroad and concurrent degrees. They may also be helpful in obtaining tutorial assistance or evaluating transfer/ advanced placement credit, as appropriate. Students often ask their advisors to provide letters of recommendation for scholarships, study abroad, employment, or graduate school;
- *Availability.* Students should expect to have ready access to their advisors. Most advisors set aside several hours each week for advising and will usually make appointments outside those hours if necessary.

What not to expect from your faculty advisor:

- *Assessment of Effort or Study Time Required for Specific Courses.* Faculty advisors may help you determine the appropriateness of a given course in your curriculum plan, but they cannot predict how difficult the course will be or how much effort or study time it will require for individual students;
- *Tutoring/Study Skills.* Faculty advisors may help you identify the need for tutoring, remedial course work, or improved study skills but should not be expected to provide the necessary assistance. Students in need of such assistance are generally referred to other resources, such as Engineering Learning Initiatives, the Learning Strategies Center or Engineering Advising;
- *Help with Personal, Financial or Housing Issues.* Students are encouraged to make their advisors aware of problems that may interfere with academic progress, but faculty advisors are not trained to provide counseling for personal problems, nor should they be expected to resolve housing or financial issues. However, they will refer students to the appropriate university office or program;
- *Internship/Job Search Assistance.* While students are encouraged to discuss their career interests with their faculty advisors, it is not the advisor's responsibility to provide assistance for employment searches. Students should contact Engineering Cooperative Education and Career Services office in Carpenter Hall or Cornell Career Services in Barnes Hall for help in finding employment.

Engineering Advising Staff

Engineering Advising implements the academic policies of the College Curriculum Governing Board (CCGB). The Advising staff provides a variety of advising services and programs to assist students in achieving their undergraduate academic and personal goals. Engineering Advising and CCGB evaluate good academic standing for unaffiliated students at the end of each semester and support students through the affiliation process during sophomore year.

Engineering Advising staff responsibilities include:

- Supplementing advising provided by faculty advisors and departments;

- Focusing on first- and second-year students, with continued access for upper-class students;
- Focusing primarily on issues related to the Engineering Common Curriculum and successfully affiliating with a major;
- Providing specialty advising for:
  - study abroad/international experiences;
  - pre-health careers and how to integrate requirements into curriculum;
  - transferring internally (between colleges) within Cornell;
  - student disability services;
  - major exploration including independent major and the affiliation process;
  - voluntary, required, and health leaves;
  - minors, double majors;
  - transfer credit, petitions, curricular substitutions.
- Coordinating the Early Intervention program; supporting students having academic or personal difficulties and referring students to appropriate campus resources;
- Providing case management for students who are in need of academic consideration and/or in distress.

Peer Advisors

As part of their participation in ENGRG 1050, all first-year students interact with Peer Advisors. Senior, junior, and sophomore engineering students volunteer to assist new students with the academic transition from high school to college.

Peer advisor responsibilities include:

- Collaborating with Faculty Advisors by assisting with class activities;
- Answering questions about the course enrollment process and student life;
- Encouraging and role modeling study skills and co-curricular involvement;
- Making referrals to appropriate university offices for academic and personal needs.

Directors of Undergraduate Studies/Associate Directors

In each Major, a faculty member serves as the Director of Undergraduate Studies or Associate Director (DUS/AD.) The DUS/AD works with students' faculty advisors and with the Undergraduate Coordinator (a staff member), to assist current and prospective Major students. Each Major is different, but in many cases the faculty advisor or Undergraduate Coordinator handles most advising issues, referring students to the DUS/AD for more unusual or difficult questions. In some Majors, a designated faculty member performs some of the DUS/AD advising functions.

DUS/AD responsibilities vary from Major to Major, but generally include the following:

For unaffiliated students:

- Being available for meetings in order to provide information about the Major, pre-affiliation course selection, and the affiliation and transfer processes;

- Serving as the public face of the Major at info sessions, ENGRG 1050 events, and Major fairs.

For affiliated students:

- Ensuring that up-to-date degree requirements and course offerings are publicized to faculty and students;
- Serving as the point person for student concerns/issues with advising and curriculum;
- Advising students on substitutions for required courses, and on the process for gaining approval for any deviation from curricular requirements;
- Signing administrative paperwork when the faculty advisor is unavailable (in some Majors).

Contact information for the Directors of Undergraduate Studies/Associate Directors in each Major can be found on pages 10-11.

Undergraduate Coordinators

Each Major has an Undergraduate Coordinator who works with the Director of Undergraduate Studies (DUS) or Associate Director (AD) to help support students and faculty with any questions about the Major.

While responsibilities vary between departments, Undergraduate Coordinators are generally responsible for:

- Answering general questions about the common curriculum, affiliation and Major curriculum requirements;
- Tracking students' academic progress within the Major;
- Assisting with college forms such as transfer credit applications, petitions, add/drop forms, etc.;
- Serving as a point of contact when faculty advisor or the DUS/AD is not available;
- Being a resource to help students navigate Cornell to achieve success.

Contact information for the Undergraduate Coordinators in each Major can be found on pages 10-11.

Additional Engineering Student Services Resources

Preprofessional Advising

Students who intend to pursue graduate study in medicine, law, or business have access to resources and services designed specifically to support their professional aspirations. Students should make an appointment with Engineering Advising for general guidance and then, depending on their interests, consult the specific offices and web sites listed below.

Premedical

Students interested in medicine or other health-related careers must plan their courses early to meet the requirements of the Common Curriculum, an Engineering Major, and the

prerequisites of the intended professional schools. Engineering Advising helps students understand how course requirements fit into the Engineering curriculum. The university health careers advisor (103 Barnes Hall) assists students in preparing for admission to professional schools. Successful candidates must complete required coursework while also demonstrating experience in the field, completing standardized examinations, and submitting standardized applications. The advisor is also available to provide insight into registrations with the Cornell Health Careers Evaluation Committee (HCEC), which prepares letters of evaluation for medical and dental school applicants. For additional information, please see: http://www.career.cornell.edu, or visit the "Pre-Health Information" Blackboard page.

Prelaw

Prelaw advising is provided by Cornell Career Services, 103 Barnes Hall. For complete information, please visit www.career.cornell.edu.

Prebusiness

Students interested in business may wish to consider the Dyson Business Minor for Engineers, offered by the Dyson School of Applied Economics and Management (AEM) in the College of Agriculture and Life Sciences (CALS). Information about this minor can be found at http://dyson.cornell.edu/undergrad/minor_engineering.php, or by visiting Engineering Advising.

Diversity Programs in Engineering

The Diversity Programs in Engineering (DPE) office operates programs at the precollege, undergraduate, graduate, and faculty levels to facilitate the recruitment, development, retention, and success of all members of the engineering community, but especially those from backgrounds traditionally underrepresented in engineering. The DPE office fosters a vision of diversity appreciation reflective of the College of Engineering's strategic plan, which enables community members from all backgrounds and cultures to thrive and succeed at Cornell. The DPE office provides an institutionalized approach for meeting the needs of undergraduate and graduate students by providing community, academic, professional and personal development opportunities that support student growth and achievement. The DPE office also works collaboratively with university and external partners to administer mentoring, tutoring, and academic success programs; graduate school preparation and undergraduate research opportunities; graduate student fellowship programs; and precollege outreach initiatives.

Student organizations affiliated with DPE include the American Indian Science & Engineering Society (AISES), the National Society of Black Engineers (NSBE), the Society of Asian Scientists and Engineers (SASE), the Society of Hispanic Professional Engineers (SHPE), the Society of Women Engineers (SWE), and Women in Computing at Cornell (WICC).

For more information, call (607) 255-6403, email dpeng@cornell.edu, stop by 146 Olin Hall, or visit www.engineering.cornell.edu/diversity.

Cornell Engineering Career Center

The Cornell Engineering Career Center office assists students who are contemplating

their career development, whether through employment (full-time entry-level, co-op, or summer) or further graduate study.

The office coordinates an on-campus recruiting program that annually brings 150+ employers to campus to conduct more than 5,000 interviews with engineering students for full-time entry-level, co-op, and summer positions. Also, in conjunction with Cornell Career Services, an extensive list of electronic job postings is maintained on Cornell's Handshake System. The office coordinates seminars on job search and résumé/interview preparation, and counselors are available to discuss career-related issues individually and in group settings.

Engineering Cooperative Education Program

The Engineering Cooperative Education Program (Co-op) provides an opportunity for juniors to gain 28 weeks of paid career-related work experience over a semester and a summer with employers nationwide and beyond. Co-op is an excellent way to explore career interests while acquiring an understanding of relevant career paths. Students must be enrolled in the College of Engineering (Computer Science and Biological Engineering Majors outside the college are also eligible). In most cases, a GPA >2.7 is required. For more information, please see the *Special Programs* section of this handbook (pages 123–126) or visit www.engineering.cornell.edu/coop.

For additional information on Cornell Engineering Career Center, see the Career and Professional Development section, pages 156-159.

Engineering Learning Initiatives

Engineering Learning Initiatives, 167 Olin Hall, facilitates academic opportunities for engineering students that enhance the learning environment, support teaching excellence, and cultivate professional development. The programs are outlined below. For more information call 255.9622, send email to eng-learning@cornell.edu, or visit www.engineering.cornell.edu/learning.

Academic Excellence Workshops (AEW)

Academic Excellence Workshops are optional, 1-credit, supplemental courses taken in conjunction with core engineering courses in math, computer science, chemistry, and statistics. AEWs meet weekly for two-hour collaborative problem-solving sessions. Designed to enhance student understanding, the workshops are facilitated by undergraduate peer educators, and feature group work on problems at or above the level of course instruction. AEWs are based on research showing that cooperative methods (as opposed to an individual, competitive approach to learning) promote higher grades, greater persistence, deeper comprehension, more enjoyment in learning, and more positive attitudes toward academic work. For more information on AEWs, visit www.engineering.cornell.edu/aew.

Tutors-on-Call

Peer tutors are available free of charge for many first- and second-year core engineering courses, including MATH, CHEM, PHYS, CS, and some distribution courses. Peer tutors, who must have a 3.0 GPA and have earned at least B in the course they tutor, earn an hourly wage and are trained to help their peers master course content and improve learning skills. The one-on-one tutoring is tailored to the individual needs of the student. To request a tutor, go to www.engineering.cornell.edu/tutoring to complete the online

Tutor Request Form, or visit the Engineering Learning Initiatives office in 167 Olin Hall to submit a paper copy.

Engineering Registrar

The Engineering Registrar's Office, located in 158 Olin Hall, is the main repository of all engineering undergraduate and Master of Engineering student records. The Registrar's Office oversees all course enrollment, grading, course scheduling, room assignments, and examination scheduling for the College of Engineering. It is responsible for maintaining current student information on the university's student data systems, including all grade, enrollment, affiliation, and transfer credit changes. Additionally, the office manages diploma ordering and official degree posting for all graduating engineering students, ensuring that all requirements are satisfied for the Bachelor of Science degree. The Registrar's Office also provides student verification letters, petition processing, and assistance with other student registration issues. Official documents relating to academic matters are filed as part of each student's permanent record and held there.

Students who need an official transcript or certification of enrollment should visit the Office of the University Registrar, http://registrar.sas.cornell.edu, located in B07 Day Hall.

University Student Records Policy

The university regards a student's enrollment status (e.g. registered, on leave, withdrawn) as directory information that may be released unless a student submits a "no-release" request to the University Registrar. Additionally, where the university believes that it is in a dependent student's best interest, information from the student's educational records may, at the university's discretion, be released to the parents or legal guardians of a dependent student. Such disclosure will generally be limited to information about a student's official status at the university, but parents or legal guardians of a dependent student may also be notified when a student has voluntarily withdrawn from the university or has been required to withdraw; when a student has been placed on academic warning; when the student's academic good standing or promotion is at issue; when a student has been placed on disciplinary probation or restriction; or when a student otherwise engages in behavior calling into question the appropriateness of the student's continued enrollment in the university. Unless otherwise indicated in writing by the student at the time of registration, or thereafter, the university will presume that a full-time undergraduate student is a dependent as that term is defined in the Internal Revenue Code.

Applying for Major Affiliation

Students apply for affiliation with a Major during either the first or second semester of their second year. Earlier affiliation may be granted at the discretion of the Major*.

To apply for affiliation, students visit the office of the undergraduate Major consultant in the Major of their choice and complete an Application for Major Affiliation. To affiliate, students must: (1) have a cumulative grade point average (GPA) >2.0; and (2) have satisfied the Major's specific course and grade requirements (see list below).

*Students who are not affiliated or conditionally affiliated with a Major by the beginning of their fifth semester will be withdrawn from the College of Engineering.

Major Descriptions, Flow Charts, and Check Lists

Each Major program is described in detail in *Courses of Study*. The descriptions of these programs begin on page 31. Because it is difficult to depict the flexibility that makes it possible to take some courses in semesters other than those indicated, **these charts are meant only to suggest the structure of the program**, and do not include the requirements for liberal studies and physical education classes. The sequence of courses may also be influenced by advanced placement or transfer credit.

Degree requirements differ from Major to Major. In addition to completing the requirements of the Common Curriculum, students must take courses that constitute the Major; they must earn grades that are adequate to remain in good standing (see page 138 for specific Major requirements for good standing); and they must accumulate sufficient credits for their degree. Each of these three parameters differs by Major, and students are responsible for knowing and meeting the requirements of their Major. Specific Major requirements are set forth later in this handbook and in *Courses of Study.* Students should consult their undergraduate Major consultants (listed on pages 10-11) and their faculty advisors if they have questions regarding the requirements.

Requirements for Major Affiliation

Biological Engineering (BE)

Minimum GPA of ≥2.5 and at most one grade below C– in math, science, and engineering courses. Completion of BEE/ENGRD 2600 or 2510 with at least C-, and one year of Introductory Biology with grades of at least C-. No more than two credits of research/project team and two credits of arts performance courses will count towards the cum GPA. Completion of all College of Engineering core requirements by the end of the sophomore year (also applies to transfer students).

Biomedical Engineering (BME)

Minimum GPA of 2.5 in required math, science, and engineering courses completed with at most one grade below C-. Research/project team credit does not apply to this GPA.

Completion of BIOMG 1350 or BIOG 1440 and BIOG 1500 with grades of at least C. Advanced Placement (AP, IB, GCE credit) CANNOT be used to satisfy this requirement.

Completion of CS1110/1112/1114/1115 and ENGRD 2202 with minimum combined GPA of 2.5 and no grade less than C-.

Completion of designated College of Engineering common curriculum by the end of semester 3 of sophomore year (see list below).

For any course that is repeated, the two grades will be averaged.

Meeting the above requirements does not guarantee affiliation with the BME major. During the first years of this new major a selection process balancing the above criteria will be required to manage enrollment. A supplemental application will be distributed by BME upon receipt of the College of Engineering's "Application for Major Affiliation".

Participation in volunteer engagement/science-based community/internship/project team/ laboratory research activity at Cornell is encouraged.

Designated Engineering Common Curriculum to be completed by **end of semester 3** of sophomore year:

MATH 1910, 1920, 2930
PHYS 1112, 2213
CHEM 2090
BME 2000/ENGRD 2202
Any ENGRI
CS 111X

Chemical Engineering (ChemE)

At most one grade below C- in chemistry, math, physics, and chemical engineering courses, and a GPA ≥2.2 in math, science, and chemical engineering courses. Visit the ChemE undergraduate web site for additional details: www.cheme.cornell.edu/cbe/academics/undergraduate/index.cfm.

Civil Engineering (CE)

GPA ≥2.0 for all engineering and science courses. At least C in ENGRD 2020.

Computer Science (CS)

At least C (not C–) in all completed CS and math courses. GPA ≥2.5 in CS 2110 (or CS 2112) and 2800. GPA ≥2.5 in MATH 1920 and CS 2800. Qualifying courses must be taken at Cornell for a letter grade. Visit the CS undergraduate web site to learn about alternative criteria for affiliation: www.cs.cornell.edu/undergrad/index.htm.

Electrical and Computer Engineering (ECE)

At least C+ in MATH 2930, PHYS 2213, and one of ECE/ENGRD 2100, ECE 2200, and ECE/ENGRD 2300. GPA ≥2.5 in the following courses if completed: MATH 1920, 2930, 2940; PHYS 2213; ECE/ENGRD 2100; ECE 2200; ENGRD/CS 2110, ECE/ENGRD 2300.

Engineering Physics (EP)

At least B– in all required math and physics courses (MATH 1910, MATH 1920, MATH 2930, MATH 2940, PHYS 1112/1116, PHYS 2213/2217, PHYS 2214/2218).

Environmental Engineering (EnvE)

GPA ≥2.0 for all engineering and science courses. At least C– in BEE/ENGRD 2510.

Independent Major (IM)

At least 12 credits (ENGRG 1050 and AEW's count; courses below 1100 and PE do not count) taken each semester. At least two courses (≥3 credits each) in required common curricular mathematics, science, and engineering courses (project teams, research, independent study, ENGRG and ENGRC's not included). At least one ENGRD by the end of the third semester with a grade of at least C–. At least a C– in required mathematics courses. No more than one grade below C each semester in mathematics, science, and engineering courses. Semester GPA ≥2.0. Cumulative GPA ≥2.0. No F, U, UX or INC grades. Students not in good standing in the college may apply to the IM but are not guaranteed admission. The IM Academic Review Committee will review applications submitted by students not in good standing as per above.

Information Science, Systems, Technology (ISST)

At least C in two of MATH 2940, CS 2110, and ENGRD 2700. GPA ≥2.3 in completed math, ENGRD, and ISST Major courses. Qualifying courses must be taken at Cornell, and for a letter grade. For a repeated course, the most recent grade is used.

Materials Science and Engineering (MSE)

Cumulative GPA ≥2.0 in the required math, physics, and chemistry courses and at least C in ENGRD 2610 or 2620. Alternatively, at least B- in the following: MATH 2930, PHYS 2213, CHEM 2090, and ENGRD 2610 or 2620.

Mechanical Engineering (ME)

At least C– in ENGRD 2020 and all completed required math, physics, chemistry, and computer science courses. (ENGRD 2210 is recommended prior to affiliation.) GPA ≥2.5 in these courses: MATH 2930, PHYS 2213, ENGRD 2020, and ENGRD 2210 (if taken).

Operations Research and Engineering (ORE)

At least C in ENGRD 2700 and MATH 2940. GPA ≥2.2 in math, science, and engineering courses (both overall and in the term immediately before affiliation). At least C– in all completed ORIE courses. Good academic standing in the college.

Science of Earth Systems (SES)

At least C- in all completed Major required courses. GPA ≥2.0 in all math, science, and engineering courses. Good academic standing in the college.

Major Programs

Each Major program is described using a chart that depicts when courses are usually taken: The charts are meant only to suggest the structure of the program and do not include liberal studies and Physical Education requirements.

Major: Biological Engineering (BE)

Accredited by ABET (see inside front cover)
Offered by: Department of Biological and Environmental Engineering
207 Riley-Robb Hall, 255.2173, www.bee.cornell.edu

Our Commitment

The educational objectives of the Biological Engineering program are consistent with those of the College of Engineering and Cornell University. We are committed to providing an excellent undergraduate engineering program in a nurturing learning environment where our graduates acquire knowledge and develop skills for professional success. Graduates of our program include a diverse group of leaders and problem solvers who contribute technically, professionally, and personally to our society.

Program Objectives

- Produce graduates who pursue careers related to Biological Engineering based on a solid educational background in appropriate mathematics, physical and life sciences, liberal studies, and engineering.
- Produce graduates who pursue advanced degrees in engineering and related professional fields.

Engineering Distributions

ENGRD 2020: Mechanics of Solids (required)

ENGRD 2XXX: ENGRD 2600: Principles of Biological Engineering (recommended) *or*
ENGRD 2510: Engineering Processes for Environmental Sustainability

Required Major Courses

Choose two of the following four:

BIOMG 1350: Cell and Developmental Biology
BIOG 1440: Comparative Physiology
BIOG 1445: Comparative Physiology, personalized instruction
BIOEE/BIOSM 1610: Ecology and the Environment
plus
BIOG/BIOSM 1500: Investigative Biology Laboratory

BIOMG 3300 or 3330 or 3350: Principles of Biochemistry, *or*
BIOMG 3310 and BIOMG 3320: Principles of Biochemistry

BIO XXXX: Biological Science course(s) with a biology prerequisite

BEE 2600/ENGRD 2600: Principles of Biological Engineering, *or*

BEE 2600/ENGRD 2600: Principles of Biological Engineering, *or*
BEE 2510/ENGRD 2510: Engineering Processes for Environmental Sustainability

BEE 3400: Design and Analysis of Biomaterials

BEE 3500: Heat and Mass Transfer in Biological Engineering

BEE/BME 3600: Molecular and Cellular Bioengineering

BEE 4500: Bioinstrumentation

BEE 2220: Bioengineering Thermodynamics and Kinetics, *or*
ENGRD 2210: Thermodynamics, *or*
CHEME 3130: Chemical Engineering Thermodynamics, *or*
MSE 3030: Thermodynamics of Condensed Systems

CEE 3040: Uncertainty Analysis in Engineering, *or*
ENGRD 2700: Basic Engineering Probability and Statistics

BEE 3310: Bio-Fluid Mechanics

Focus Area: Five or more courses picked from one or more of the seven focus areas.

Biological Engineering Focus Area electives to complete remaining credits.

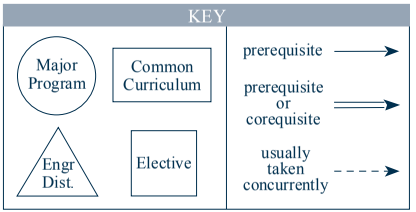
Biological Engineering Focus Area Electives

One course must be a BEE Capstone course and one must be a BEE Laboratory Experience course (see department handbook for a current list of approved courses). BE Focus Areas: Molecular and Cellular Systems, Ecological and Microbial Systems, Nanobiotechnology, Systems and Computational Biology, Synthetic Biology, Biomaterials, or Sustainability (see department handbook for a current list of approved Focus Area electives).

One course must satisfy the College of Engineering technical writing requirement.

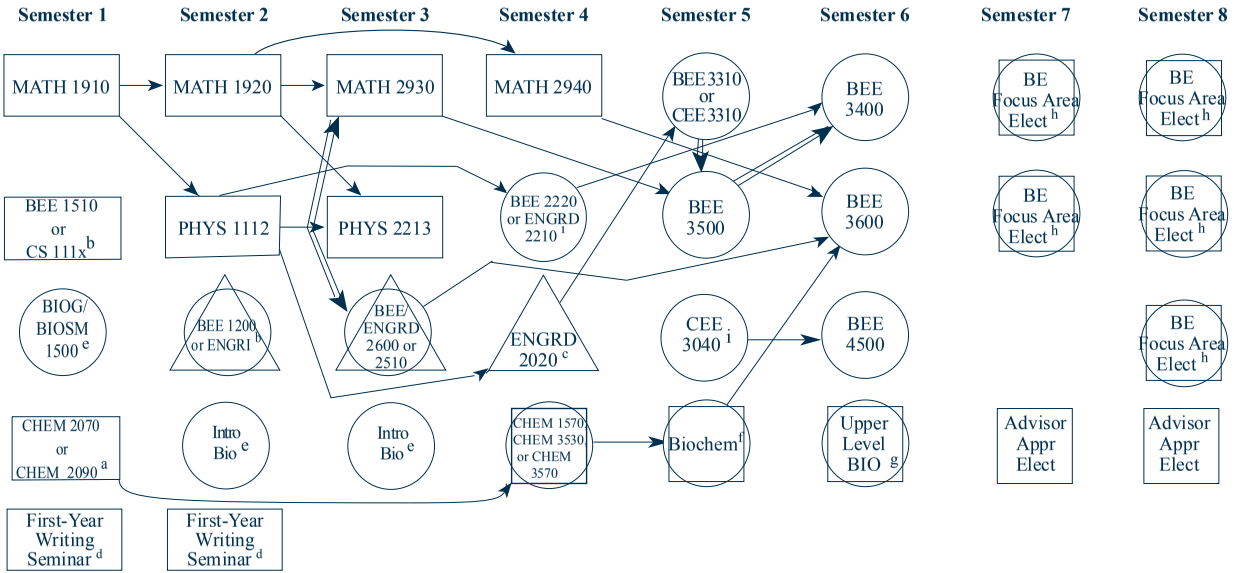
The requirements for premedical study can be met with an additional 6–9 credits if courses are carefully selected.

Biological Engineering Major (BE)



Requirements for Major Affiliation: Biological Engineering

Minimum GPA of ≥2.5 and at most one grade below C– in math, science, and engineering courses. Completion of BEE/ENGRD 2600 or 2510 with at least C-, and one year of Introductory Biology with grades of at least C-. No more than two credits of research/project team and two credits of arts performance courses will count towards the cum GPA. Completion of all College of Engineering core requirements by the end of the sophomore year (also applies to transfer students).



NOTE: Liberal Studies Distribution and Physical Education requirements are not represented on this chart.

Biological Engineering Major Check List

	Min. Cr. Hrs.	√ When Done
MATH 1910	4	☐
MATH 1920	4	☐
MATH 2930	4	☐
MATH 2940	4	☐
CHEM 2090 or CHEM 2070 (or 2150)[a]	4	☐
CHEM 1570 (or 3530 or 3570)	3	☐
PHYS 1112 (or 1116)	4	☐
PHYS 2213 (or 2217)	4	☐
CS 1110, CS 1112, CS 1114, CS 1115, or BEE 1510[b]	4	☐
Introduction to Engineering: ENGRI 1XXX or BEE 1200[b]	3/1	☐
Engineering Distribution 1: ENGRD 2020	4	☐
Engineering Distribution 2: BEE/ENGRD 2600 (recommended), *or* BEE/ENGRD 2510	3	☐
First-Year Writing Seminar 1[d]	3	☐
First-Year Writing Seminar 2	3	☐
Liberal Studies Distribution: six courses, 18-credit minimum	18	
Liberal Studies 1		☐
Liberal Studies 2		☐
Liberal Studies 3		☐
Liberal Studies 4		☐
Liberal Studies 5		☐
Liberal Studies 6		☐
Advisor-approved Elective 1: two courses, 6-credit minimum	6	☐
Advisor-approved Elective 2		
Required Major Courses (51-credit minimum)[c, j]		
Intro BIO[e]	3	☐
Intro BIO	3	☐
BIOG/BIOSM 1500[e]	2	☐
Biochemistry[f]	4/5	☐
Upper-level Biology[g]	3	☐
BEE 3500	3	☐
BEE 2220 or ENGRD 2210 or CHEME 3130 or MSE 3030[i]	3	☐
BEE 3310	4	☐
Engineering Statistics: CEE 3040 or ENGRD 2700[i]	4/3	☐
BEE 3400	3	☐
BEE 3600	3	☐
BEE 4500	3/4	☐
BE Focus Area Elective[h]	3	☐
BE Focus Area Elective	3	☐
BE Focus Area Elective	3	☐
BE Focus Area Elective	3	☐
BE Focus Area Elective	3	☐
Total Required Credits	126 minimum	
Capstone Design Requirement		☐
Laboratory Experience Requirement		☐

Technical Writing Course[d] ☐ Physical Education 1 sem ☐ 2 sem ☐ swim test ☐

Notes

a. Engineering matriculates must enroll in CHEM 2090 (fall, spring); CALS matriculates must enroll in CHEM 2070 (fall). Students in either college may also substitute CHEM 2150 for either CHEM 2090 or 2070.

b. CS 111X and ENGRI required of engineering matriculates. BEE 1510 and BEE 1200 required of CALS matriculates.

c. The Major program includes nine (9) credits of courses outside the Major. These are satisfied by ENGRD 2020, CEE 3040 or ENGRD 2700, and a non-BEE Major-approved elective.

d. In addition to the First-year Writing Seminars, a technical writing course must be taken as an engineering distribution, liberal studies, Advisor-approved elective, or Major course.

e. Choose two of the following four biology courses: BIOMG 1350, BIOG 1440, BIOG 1445, or BIOEE/BIOSM 1610, plus BIOG/BIOSM 1500. BIOG/BIOSM 1500 may be taken in spring. All BIO courses must be taken for letter grade.

f. Biochemistry is required: BIOMG 3300 or BIOMG 3330 or BIOMG 3350 or BIOMG 3310 plus BIOMG 3320.

g. Upper-level Biology: Any biology course at the 2000-level or above which has a biology prerequisite and is taken for a letter grade. This requirement may also be satisfied by an upper-level course in a science department (excluding engineering, fine arts, liberal studies and mathematics) which has a biology (not social science) content of 95% or greater and a biology prerequisite. Students must receive approval for these alternative courses by consulting their BE faculty advisor or the main BE Advising Office, 207 Riley-Robb Hall. One credit seminars and BIOG 2990/4990 credits may not be used to meet this requirement.

h. BE Focus Area Electives must include a BEE capstone design course and a BEE laboratory experience course. See beadvised.bee.cornell.edu for a current list of approved courses. In place of one focus area course, you may use up to 4 credits of research, project team, teaching, or independent study taken in an engineering department towards the 46 engineering credits in category 8.

i. BEE 2220 or ENGRD 2210 or CHEME 3130 or MSE 3030 and ENGR Stats preferably before semester 6. CEE 3040 is the preferred version of statistics.

j. Forty-six of the 51 minimum Required Major Course credits must be Engineering courses (including distribution courses).

Major: Biomedical Engineering (BME)

Accredited by: NY State Department of Education
Offered by: Nancy E. and Peter C. Meinig School of Biomedical Engineering
101 Weill Hall, 254.3368

Program Mission

The mission of the B.S. program in Biomedical Engineering is to train students in the practice of design, fabrication, and analysis of biomedical systems, devices, diagnostics, and therapeutics. Specifically, Cornell's vision for Biomedical Engineering centers around a quantitative approach to understanding biology across length and time scales, with a focus on issues related to human health. The quantitative nature of this program distinguishes the major from traditional programs in biology, while the focus on human health is distinct from other programs in engineering that include the study of biological systems (e.g. Biological and Environmental Engineering and Chemical and Biomolecular Engineering). Additionally, its focus on multiscale analysis of biological systems is a unique signature of Cornell Biomedical Engineering relative to programs at peer institutions.

Program Objectives

Biomedical Engineering is a leader in developing research that spans the Ithaca and New York City campuses, including Weill Cornell Medical College and Cornell Tech. Our objective is to create world-class graduates to meet the 21st century needs of biomedical-related industries focused on medical devices and pharmaceuticals, as well as government and private consulting practice. We also aim to produce intellectual and technical leaders for graduate education in medicine or engineering. Most importantly, we aim to create a diverse community of life-long learners who are innovation confident, collaborative across disciplines, and community engaged.

Objective 1: Teach our students to apply engineering principles to understand and predict the behavior of biological and physiological systems relevant to human health and disease

Objective 2: Train our students in the theory and practice of biomedical engineering design and technology creation

Objective 3: Train our students to engineer robust solutions within highly variable and complex biomedical problems

Objective 4: Build critical leadership, interpersonal and professional skills to thrive within diverse team environments and prepare for life-long learning

Objective 5: Provide our students with opportunities for an experiential learning approach based on biomedical applications

Objective 6: To provide a complementary liberal education in humanities, history and social sciences

Engineering Distributions

ENGRD 2202: Biomedical Transport Phenomena (required)

ENGRD 2020: Statics and Mechanics of Solids (recommended)[a]

Required Major Courses

BIOG 1440: Introductory Biology: Comparative Physiology, *or*
BIOMG 1350: Introductory Biology: Cell and Developmental Biology

BIOG 1500: Investigative Biology Lab

BME 2010: Physiology of Human Health and Disease

BME 2110: Biomolecular Thermodynamics and Physical Chemistry

BME 2210: Biomedical Applications of Materials

BME 2310: Biomedical Signals and Systems Analysis

BME 3010: Molecular Principles of Biomedical Engineering

BME 3020: Cellular Principles of Biomedical Engineering

BME 3030: Biomedical Instrumentation and Technology Fabrication

BME 4010: Biomedical Engineering Analysis of Metabolic and Structural Systems

BME 4020: Electrical and Chemical Physiology

BME 4080/4090: Biomedical Engineering Design Laboratory

BTRY 3010: Biological Statistics[b]
ENGRD 2020: Statistics and Mechanics of Solids[a]

Biomedical Engineering Concentrations (Must Choose 1)

Molecular, Cellular, and Tissue Engineering (MCTE)

Required Courses:
CHEM 1570: Introduction to Organic and Biological Chemistry[c]

BME 3110: Engineering and Computational Analysis of Cellular Systems

BME 4190: MCTE Practicum Laboratory

Electives:
Choose 6 credits from the following courses:

BTRY 4381: Bioinformatics Programming

BME 5850: Current Practices in Tissue Engineering

BME 5830: Cell-Biomaterials Interactions

CHEME 5430: Bioprocess Engineering

OR 1 3xxx/4xxx course from another BME Concentration

Biomedical Materials and Drug Delivery (BMDD)

Required Courses:
CHEM 1570: Introduction to Organic and Biological Chemistry[c]

BME 3210: BDD Concentration Course

BME 4190: MCTE Practicum Laboratory, *or*
BME 4490: BMMB Practicum Laboratory

Electives:
Choose 6 credits from the following courses:

MSE 4020: Mechanical Properties of Materials; Processing and Design, *or*
MAE 4640: Orthopedic Tissue Mechanics, *or*
MSE 5230: Physics of Soft Materials, *or*
BME 5810: Soft Tissue Biomechanics

BEE 3400: Design and Analysis of Biomaterials

CBE 5430: Bioprocess Engineering

MSE 5550: Introduction to Composite Materials

MSE 5620: Biomineralization

BME 5830: Cell-Biomaterial Interactions

BME 5850: Current Advances in Tissue Engineering

Biomedical Imaging and Instrumentation (BII)

Required Courses:
PHYS 2214: Physics III: Oscillations, Waves, and Quantum Physics[e]

BME 3310: Medical and Preclinical Imaging

BME 4390: Electronics for Biomedical Engineers

Electives:
Choose 6 credits from the following courses:

AEP 3300: Modern Experimental Optics

ECE 4300: Lasers and Optoelectronics

ECE 4910: Principles of Neurophysiology

ECE 4760: Designing with Microcontrollers

Biomedical Mechanics and Mechanobiology (BMMB)

Required Courses:

PHYS 2214: Physics III: Oscillations, Waves, and Quantum Physics[e]

BME 4410: BMMB Concentration Course

BME 4490: BMMB Practicum Laboratory

Electives:
Choose 6 credits from the following courses:

MAE 4640: Orthopaedic Biomechanics

MAE 4680: Biofluid Mechanics

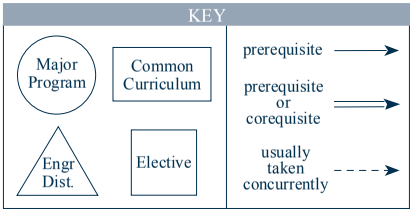
BME 5810: Soft Tissue Biomechanics

MSE 5130: Mechanobiology of Materials and Cells

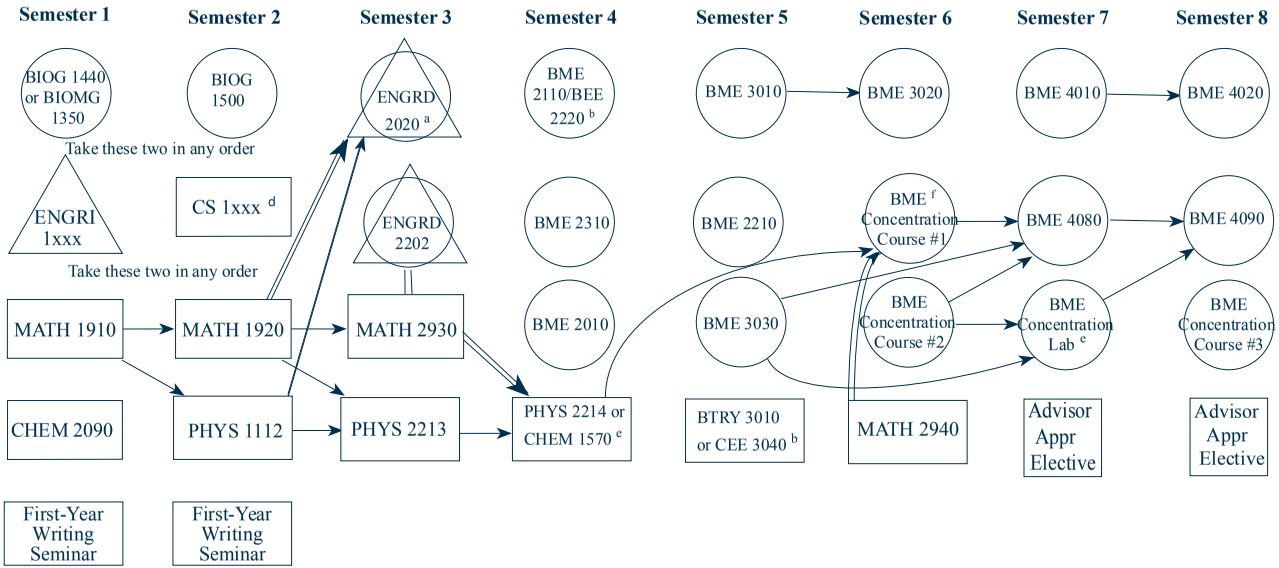
BEE 3310: Bio-Fluid Mechanics

BEE 4530: Computer Aided Engineering

Biomedical Engineering Major (BME)



Requirements for Major Affiliation: Biomedical Engineering
Affiliation requirements are available on the Engineering Advising display board in 167 Olin Hall, or visit the BME undergraduate website at http://www.bme.cornell.edu/bme/academics/undergraduate/affiliation/index.cfm



Note: Liberal Studies Distribution and Physical Education requirements are not represented on this chart.

Biomedical Engineering Major Check List

	Min. Credit Hrs	√ When Done
Core Science and Engineering Courses (69 credit minimum)		
MATH 1910	4	☐
MATH 1920	4	☐
MATH 2930	4	☐
MATH 2940	4	☐
CHEM 2090	4	☐
PHYS 1112 (or 1116)	4	☐
PHYS 2213 (or 2217)	4	☐
PHYS 2214 or CHEM 1570[c]	4	☐
CS 1112 (or 1110, or 1114, or 1115)[d]	4	☐
Introduction to Engineering: ENGRI 1XXX	3	☐
Engineering Distribution 1: ENGRD 2202 (required)	3	☐
Engineering Distribution 2: ENGRD 2XXX[a]	3	☐
First-Year Writing Seminar 1[f]	3	☐
First-Year Writing Seminar 2	3	☐
Liberal Studies Distribution: six courses, 18-credit minimum	18	
Liberal Studies 1		☐
Liberal Studies 2		☐
Liberal Studies 3		☐
Liberal Studies 4		☐
Liberal Studies 5		☐
Liberal Studies 6		☐
Advisor-approved Elective 1: two courses, 6-credit minimum	6	☐
Advisor-approved Elective 2		☐
Required Major Courses (58 credit minimum)[d]		
BIOMG 1350 or BIOG 1440 (or BIOG 1445)	3	☐
BIOG 1500	2	☐
ENGRD 2020[a]	3	☐
BTRY 3010 or CEE 3040[b]	4	☐
BME 2010	3	☐
BME 2110	3	☐
BME 2210	3	☐
BME 2310	3	☐
BME 3010	3	☐
BME 3020	3	☐
BME 3030	3	☐
BME 4010	3	☐
BME 4020	3	☐
BME 4080	3	☐
BME 4090	3	☐
BME Concentration (13 credit minimum)[f]		
BME Concentration Course 1	3	☐
BME Concentration Course 2	3	☐
BME Concentration Course 3	3	☐
BME Concentration Laboratory (BME 4190, 4390, or 4490)	4	☐
Total Required Credits	130 minimum	

Technical Writing Course[f]: BME Concentration Lab

Physical Education: 1 sem ☐ 2 sem ☐ swim test ☐

Notes

a. Recommended: ENGRD 2020. ENGRD 2020 satisfies the Common Curriculum distribution requirement and also fulfills a required Major course. It is best taken during semester 3 and must be completed before semester 5.

b. CEE 3040 alternatively satisfies this course.

c. The choice between PHYS 2214 or CHEM 1570 depends on the concentration chosen within the Major. CHEM 1570 can also be satisfied by the pre-medicine organic chemistry/ biochemistry sequence. PHYS 2214 is recommended for Biomedical Imaging and Instrumentation (BII), and Biomedical Mechanics and Mechanobiology (BMMB); CHEM 1570 is recommended for Molecular/Cellular/Tissue Engineering (MCTE), and Biomaterials and Drug Delivery (BDD).

d. Introduction to Computing (CS 1110, 1112, CS 1114, or CS 1115) is required for affiliation. CS 1112 is strongly recommended.

e. In addition to the First-year Writing Seminars, a technical writing course must be taken as an engineering distribution, liberal studies, approved elective, or Major course. This requirement will be satisfied with the BME Concentration Laboratory.

f. Students will choose 3 BME Concentration Courses and one BME Concentration Laboratory in one of the following concentration areas: Molecular/Cellular/Tissue Engineering (MCTE), Biomaterials and Drug Delivery (BDD), Biomedical Imaging and Instrumentation (BII), and Biomedical Mechanics and Mechanobiology (BMMB).

Major: Chemical Engineering (ChemE)

Accredited by ABET (see inside front cover)
Offered by: Robert Frederick Smith School of Chemical and Biomolecular Engineering
226 Olin Hall, 255.1489, www.cheme.cornell.edu

Program Objectives

Our objectives are designed to meet the needs of our constituents: our students, our graduates, the employers of our graduates, the graduate programs that our graduates enter, the chemical engineering professional community, and society in general.

Objective 1. To teach our students to analyze and design chemical processes that span molecular to macroscopic scales.

Objective 2. To teach our students interpersonal skills necessary in a professional environment.

Objective 3. To provide a liberal education in humanities and history.

Objective 4. To create scholars and professionals.

Engineering Distributions

ENGRD 2190: Mass and Energy Balances (required)

CHEM 3890: Honors Physical Chemistry I (recommended)[b]

Required Major Courses

CHEM 2510: Introduction to Experimental Organic Chemistry

CHEM 2900: Introductory Physical Chemistry Laboratory

CHEM 3570: Organic Chemistry for the Life Sciences[g], *or*
CHEM 3530: Principles of Organic Chemistry, *or*
CHEM 3590: Honors Organic Chemistry I[g]

CHEM 3900: Honors Physical Chemistry II

CHEME 3010: Career Perspectives

CHEME 3130: Chemical Engineering Thermodynamics

CHEME 3230: Fluid Mechanics

CHEME 3240: Heat and Mass Transfer

CHEME 3320: Analysis of Separation Processes

CHEME 3720: Introduction to Process Dynamics and Control

CHEME 3900: Chemical Kinetics and Reactor Design

CHEME 4320: Chemical Engineering Laboratory

CHEME 4620: Chemical Process Design

Electives[e]

Six credits of advanced chemical engineering electives chosen from:

CHEME 4010: Molecular Principles of Biomedical Engineering

CHEME 4020: Cellular Principles of Biomedical Engineering

CHEME 4130: Introduction to Nuclear Science and Engineering

CHEME 4610: Concepts of Chemical Engineering Product Design

CHEME 4630: Practice of Chemical Engineering Product Design

CHEME 4700: Process Control Strategies

CHEME 4810: Biomedical Engineering

CHEME 4840: Microchemical and Microfluidic Systems

CHEME 5430: Bioprocess Engineering

CHEME 5440: Systems Biology in Biotechnology and Medicine

CHEME 6240/MAE 6240: Physics of Micro and Nanoscale Fluid Mechanics

CHEME 6310: Engineering Principles for Drug Delivery

CHEME 6400: Polymeric Materials

CHEME 6440: Aerosols and Colloids

CHEME 6560: Membrane Separations

CHEME 6610: Air Pollution Control

CHEME 6640: Energy Economics

CHEME 6650: Energy Engineering

CHEME 6660: Analysis of Sustainable Energy Systems

CHEME 6661: Bioenergy and Biofuels Module[h]

CHEME 6662: Solar Energy Module[h]

CHEME 6663: Geothermal Energy Module[h]

CHEME 6664: Hydrokinetic and Aerodynamic (Water and Wind) Energy Module[h]

CHEME 6666: Unconventional Natural Gas Development from Shale Formations Module[h]

EAS/CHEME 6668: Earth System Behavior and Resources Module[h]

EAS/CHEME 6669: Earth Energy Science and Engineering Module[h]

CHEME 6670: Fossil Fuels Module[h]

CHEME 6671: Nuclear Energy Module[h]

CHEME 6672: Electric Power Systems Module[h]

CHEME 6673: Tools for Analyzing Energy and Society Module[h]

CHEME 6674: Energy Metals Module

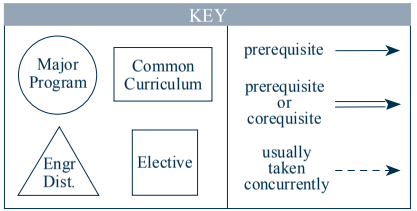
CHEME 6675: Energy Life Cycle Assessment Module

CHEME 6677: Seismic Risk in Energy Development

Four Major-approved electives[e] (includes the biology elective[f])

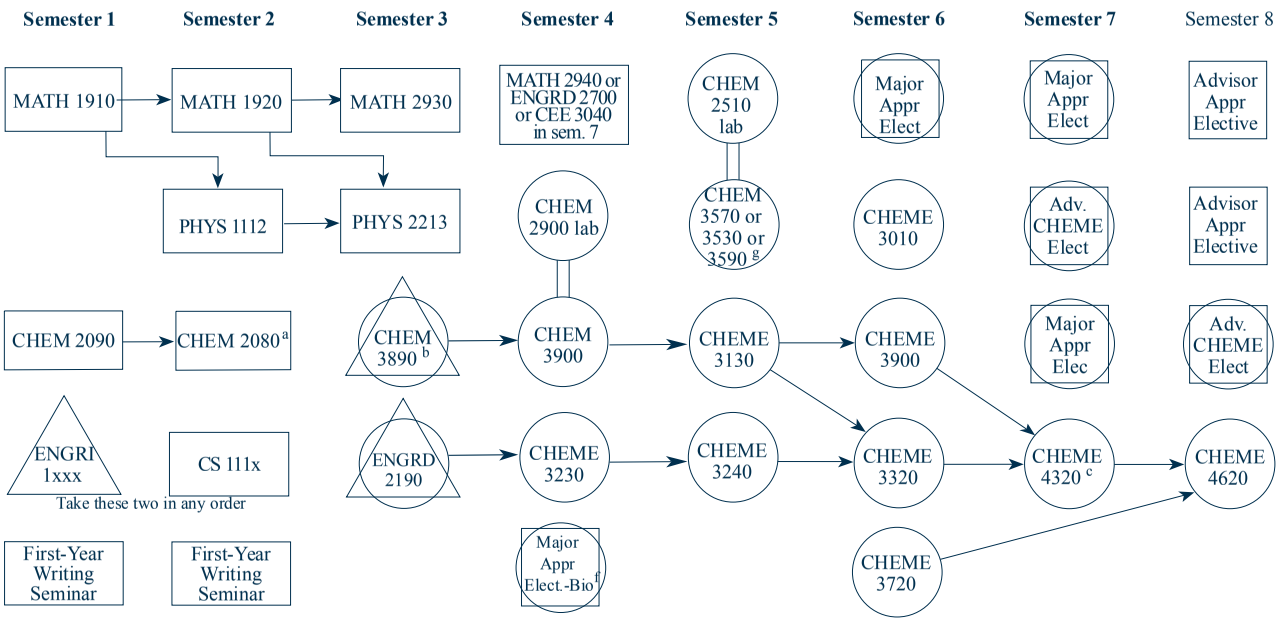
Two Advisor-approved electives[e] (includes CHEM 2080)

Chemical Engineering Major (ChemE)



Requirements for Major Affiliation: Chemical Engineering

At most one grade below C– in chemistry, math, physics, and chemical engineering courses, and a GPA ≥2.2 in math, science, and chemical engineering courses. Visit the ChemE undergraduate website for additional details: www.cheme.cornell.edu/cbe/academics/undergraduate/index.cfm.



Note: Liberal Studies Distribution and Physical Education requirements are not represented on this chart.

Chemical Engineering Major Check List

	Minimum Credit Hours	√ When Done
MATH 1910	4	☐
MATH 1920	4	☐
MATH 2930	4	☐
MATH 2940 (or CEE 3040 or ENGRD 2700)	4	☐
CHEM 2090	4	☐
CHEM 2080 (or 2150)[a]	4	☐
PHYS 1112 (or 1116)	4	☐
PHYS 2213 (or 2217)	4	☐
CS 1110 (or 1112, or 1114, or 1115)	4	☐
Introduction to Engineering: ENGRI 1XXX	3	☐
Engineering Distribution 1: ENGRD 2190	3	☐
Engineering Distribution 2: CHEM 3890 (recommended)[b]	3	☐
First-Year Writing Seminar 1[c]	3	☐
First-Year Writing Seminar 2	3	☐
Liberal Studies Distribution: six courses, 18-credit minimum	18	
Liberal Studies 1		☐
Liberal Studies 2		☐
Liberal Studies 3		☐
Liberal Studies 4		☐
Liberal Studies 5		☐
Liberal Studies 6		☐
Advisor-approved Elective 1[a]: two courses, 6-credit minimum	6	☐
Advisor-approved Elective 2		☐
Required Major Courses (52-credit minimum)[d]		
CHEME 3010	1	☐
CHEME 3130	3	☐
CHEME 3230	3	☐
CHEME 3240	3	☐
CHEME 3320	3	☐
CHEME 3720	2	☐
CHEME 3900	3	☐
CHEME 4320[c]	6	☐
CHEME 4620	5	☐
Advanced CHEME Elective 1[e, h]	3	☐
Advanced CHEME Elective 2	3	☐
Major-approved Elective 1: Biology Elective[f]	3	☐
Major-approved Elective 2:[e]	3	☐
Major-approved Elective 3:	3	☐
Major-approved Elective 4:	3	☐
Courses outside the Major:		
CHEM 2510	2	☐
CHEM 2900	2	☐
CHEM 3570[g] (or CHEM 3530 or CHEM 3590)	3	☐
CHEM 3900	4	☐
Total Required Credits	130 minimum	

Technical Writing Course[c]: CHEME 4320

Physical Education: 1 sem ☐ 2 sem ☐ swim test ☐

Notes

a. CHEM 2080 (2150) usually fulfills one of the two Advisor-approved electives.

b. CHEM 3890 is required by the Major, and it is recommended that this course be counted as an engineering distribution course. In this case, the fourth credit may apply as an Advisor-approved elective credit.

c. In addition to the first-year writing seminars, a technical writing course must be taken as an engineering distribution, liberal studies, Advisor-approved elective, or Major course (CHEME 4320: Chemical Engineering Laboratory must be completed and satisfies this requirement).

d. The Major program includes nine (9) credits of courses outside the Major. These are satisfied by courses in chemistry.

e. Electives can be taken in semester 7 and 8. Major-approved electives must be approved by your CHEME faculty advisor. Students with a biomolecular focus may use the following courses as electives: CHEME 4010 and CHEME 4020 as advanced CHEME Electives; BIOMG 3300 and CHEME 5430 or CHEME 4810 as a Major-approved elective. The Engineering Accreditation Commission of ABET requires at least 48 credits of engineering courses. The chemical engineering degree requirements provide 45 credits of engineering courses. Therefore, at least three credits of electives—Advisor-approved Electives, Major Approved Electives, or the Biology Elective—must be courses offered by the College of Engineering. If you take CEE 3040 or ENGRD 2700 in place of MATH 2940, this counts as an elective engineering course.

f. The biology elective can be taken in semester 4 or later. Each student must complete one of the seven following options for the biology elective:
   - Advanced Placement—a score of 5 on the CEEB AP exam, a score of A or B on the GCE A-Level exam, or a score of 7 on the IB Higher Level exam.
   - CHEME 2880: Biomolecular Engineering: Fundamentals and Applications (fall, 3 credits).
   - CHEME 5430: Bioprocess Engineering (fall, 3 credits).
   - Eight credits of a pre-med biology sequence; BIOG 1500: Investigative Biology Laboratory (2 credits) and BIOMG 1350: Cell and Developmental Biology (3 credits) and BIOG 1440: Comparative Physiology (3 credits) or BIOG 1445: Comparative Physiology–Personalized Instruction (4 credits) or ; BIOG 1107: General Biology (summer, 3 credits) and BIOG 1108: General Biology (summer, 3 credits) and BIOG 1500: Investigative Biology Laboratory (2 credits).
   - Three credits of microbiology—BIOMI 2900: General Microbiology Lectures (fall, spring, or six-week summer session, 3 credits).
   - Four credits of biochemistry—BIOMG 3300: Principles of Biochemistry, Individualized Instruction (fall or spring, 4 credits) or BIOMG 3330: Principles of Biochemistry: Proteins, Metabolism, and Molecular Biology (six-week summer session, 4 credits) or BIOMG 3350: Principles of Biochemistry: Proteins, Metabolism, and Molecular Biology (spring, 4 credits).
   - Five credits of biochemistry—BIOMG 3310: Principles of Biochemistry: Proteins and Metabolism (fall, 3 credits) and BIOMG 3320: Principles of Biochemistry: Molecular Biology (spring, 2 credits).

g. Premed students need 8 credits of organic chemistry. Students with a strong chemistry background, and room in their spring schedule due to AP credits, might consider taking CHEM 3590 Honors Organic Chemistry I (spring only) with CHEM 2510.

h. Three one-credit modules associated with CHEME 6660 may be combined to satisfy one Advanced Chemical Engineering Elective.

This engineering check list is formatted to conform to the general specifications of the College of Engineering. We strongly recommend that you visit 120 Olin Hall for an official Chemical and Biomolecular Engineering curriculum sheet and check list or visit www.cheme.cornell.edu/academics/undergraduate/curriculum/curriculuminfo.cfm.

Major: Civil Engineering (CE)

Accredited by ABET (see inside front cover)
Offered by: School of Civil and Environmental Engineering
221 Hollister Hall, 255.3412, www.cee.cornell.edu

Program Objectives

We are dedicated to providing the highest-quality broad-based technical, scientific, and liberal education. We create and maintain an outstanding educational program in a climate that fosters diverse skills designed for professional success. Our objectives are to prepare our students for:

- excellence in engineering decision-making and design,
- leadership careers in engineering practice,
- graduate professional engineering education,
- advanced study and research in engineering, and
- diverse, alternative career choices.

Engineering Distributions

ENGRD 2020: Mechanics of Solids (required)

Recommended Distributions

ENGRD 2110: Object-Oriented Programming and Data Structures (recommended for students interested in transportation systems engineering)

ENGRD 2210: Thermodynamics (recommended for students interested in fluid mechanics and hydraulics/hydrology)

ENGRD 2510: Engineering Processes for Environmental Sustainability (recommended for students interested in environmental engineering)

ENGRD 2610: Mechanical Properties of Materials: From Nanodevices to Superstructures (recommended for students interested in structural and geotechnical engineering)

ENGRD 3200[d,f]: Engineering Computation (recommended for all students)

Required Major Courses

BEE/ENGRD 2510[h,i]: Engineering Processes for Environmental Sustainability

CEE 4780[e]: Structural Dynamics and Earthquake Engineering, *or*
MAE 2030: Dynamics

ENGRD 3200[d,f]: Engineering Computation

CEE 3040[g]: Uncertainty Analysis in Engineering

CEE 3230: Engineering Economics and Management

CEE 3310: Fluid Mechanics

CEE 3410: Introduction to Geotechnical Engineering

CEE 3610[h,i]: Introduction to Transportation Engineering

CEE 3710 [i]: Structural Modeling and Behavior

Electives

Technical writing course (see listing of approved courses in *Courses of Study*) [c, j]

One CEE Capstone Design Elective[k]

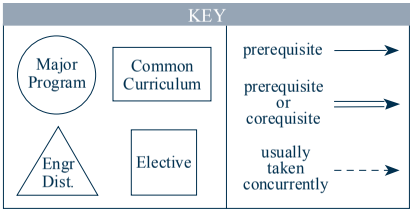
Two CEE Design Electives[k]

Two Major-approved electives[k]

Two Advisor-approved electives

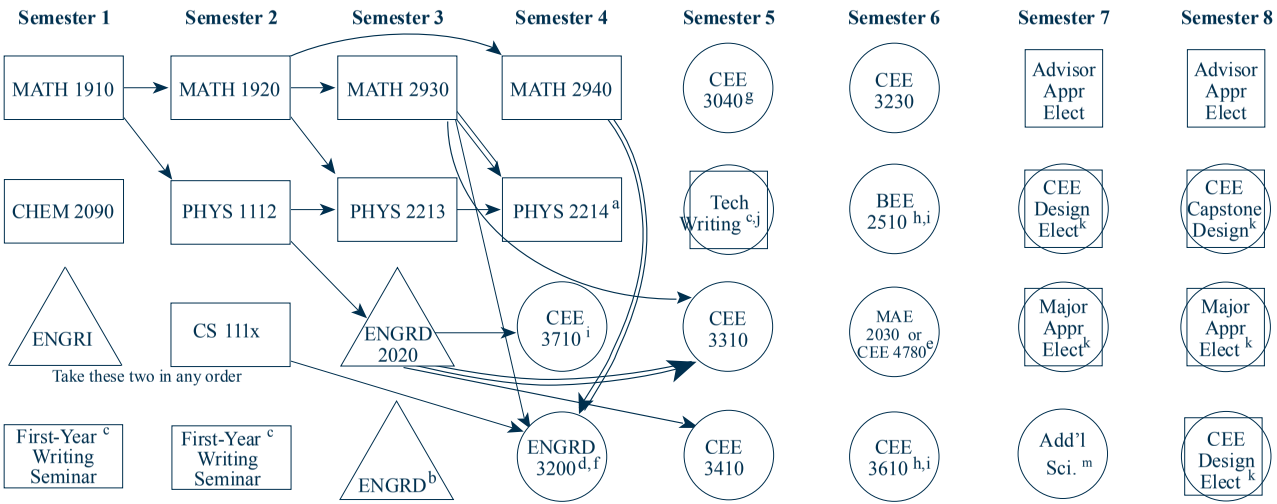
One additional science course[m]

Civil Engineering Major (CE)



Requirements for Major Affiliation: Civil Engineering

GPA ≥2.0 for all engineering and science courses. At least C in ENGRD 2020.



Note: Liberal Studies Distribution and Physical Education requirements are not represented on this chart.

Civil Engineering Major Check List

	Minimum Credit Hours	√ When Done
MATH 1910	4	☐
MATH 1920	4	☐
MATH 2930	4	☐
MATH 2940	4	☐
CHEM 2090 (or 2150)	4	☐
PHYS 1112 (or 1116)	4	☐
PHYS 2213 (or 2217)	4	☐
PHYS 2214 (or 2218)[a]	4	☐
CS 1110 (or 1112, or 1114, or 1115)	4	☐
Introduction to Engineering: ENGRI 1XXX	3	☐
Engineering Distribution 1: ENGRD 2020 (required)	4	☐
Engineering Distribution 2[b]	3	☐
First-Year Writing Seminar 1[c]	3	☐
First-Year Writing Seminar 2	3	☐
Liberal Studies Distribution: 6 courses, 18-credit minimum	18	
Liberal Studies 1		☐
Liberal Studies 2		☐
Liberal Studies 3		☐
Liberal Studies 4		☐
Liberal Studies 5		☐
Liberal Studies 6		☐
Advisor-approved Elective 1: 2 courses, 6-credit minimum	6	☐
Advisor-approved Elective 2		☐

Required Major Courses (49-credit minimum)[l]

MAE 2030 or CEE 4780[e]	3	☐
ENGRD 3200[d,f]	4	☐
BEE/ENGRD 2510 [h,i]	3	☐
CEE 3040[g]	4	☐
CEE 3230	3	☐
CEE 3310	4	☐
CEE 3410	4	☐
CEE 3610[h,i]	3	☐
CEE 3710[i]	4	☐
Technical Writing Course[j]	3	☐
CEE Capstone Design Elective 1[k]	3	☐
CEE Design Elective 2[k]	3	☐
CEE Design Elective 3[k]	3	☐
Major-approved Elective 1[k]	3	☐
Major-approved Elective 2[k]	3	☐
Total Required Credits	126 minimum	
Additional Science Course[m] (0 credits minimum, no maximum)		☐

Physical Education: 1 sem ☐ 2 sem ☐ swim test ☐

Notes

a. May substitute CHEM 2080 or CHEM 1570 for PHYS 2214.

b. Recommended: ENGRD 2610 for civil infrastructure; ENGRD 2210 for hydraulics; ENGRD 2110 for transportation; ENGRD 2510 for environmental; ENGRD 3200 for all students.

c. In addition to the first-year writing seminars, a technical writing course must be taken. The course may count as an engineering distribution, liberal studies, Advisor-approved elective, or Major course.

d. Students using this course as a second engineering distribution must take an additional Major-approved elective.

e. MAE 2030 should be taken in the second year, but CEE 4780 should not be taken until the third or fourth year.

f. ENGRD 3200 may be taken in semester 4 or 6.

g. ENGRD 2700: Basic Engineering Probability and Statistics may be accepted (by petition) as a substitute for CEE 3040 in the Major, but only if taken before affiliation, or in some special cases where co-op or study abroad programs necessitate such a substitution.

h. Students interested in pursuing a concentration in civil infrastructure (geotechnical and structural engineering) may substitute either CEE 3720: Intermediate Solid Mechanics or CEE 4710: Fundamentals of Structural Mechanics for either BEE/ENGRD 2510 or CEE 3610, if they also complete either CEE 4730: Design of Concrete Structures or CEE 4740: Introduction to the Behavior of Metal Structures. However, CEE 3720 or CEE 4710 then counts as a core course only and not as a CEE Design Elective or Major-approved elective.

i. Students may take BEE/ENGRD 2510, CEE 3610, or CEE 3710 in semester 4, depending on their interests.

j. If the technical writing requirement is met with a course that fulfills another requirement (liberal studies, Major-approved elective, etc.), then the student must take an additional elective approved by their faculty advisor.

k. To be chosen from lists available in the CE Undergraduate Office, 221 Hollister Hall. Lists of suggested courses are available for students interested in structural engineering, transportation engineering, fluid mechanics/hydrology, geotechnical engineering, water resources and environmental systems engineering, and environmental engineering.

l. The Major program includes nine (9) credits of courses outside the Major. This group of courses may include ENGRD 2020, MAE 2030, one engineering distribution or elective, and/or a CE Major course outside the Major disciplinary area.

m. Students must take one (1) additional basic science course in addition to the required physics and chemistry sequence. Courses meeting this requirement include: BIOG 1440, BIOEE 1610, BIOMG 1350, and EAS 1540, 2200, 3030, 3050, 3410, 3420, and 3530. Students may petition to have other courses approved. (Note: This course may simultaneously satisfy another requirement, such as an Advisor-approved elective.)

Major: Computer Science (CS)

Offered by: Department of Computer Science
110 Gates Hall, 255.0982, www.cs.cornell.edu/undergrad/

Program Objectives

The CS curriculum covers both the theory of algorithms and computing and their applications in science, engineering, and business. Students learn algorithmic ways of thinking and how to bring them to bear on a wide range of problems. They also study the elements of computing and information technology such as system design, problem specification, programming, system analysis and evaluation, and complex modeling.

Engineering Distributions

ENGRD 2110: Object-Oriented Programming and Data Structures (required), *or*
ENGRD 2112: Object-Oriented Design and Data Structures-Honors

Required Major Courses

CS 2800: Discrete Structures

CS 3110: Data Structures and Functional Programming

CS 3410: Computer System Organization and Programming, *or*
CS 3420/ECE 3140: Embedded Systems[d]

CS 4410: Operating Systems

CS 4820: Introduction to Analysis of Algorithms

Electives

Three CS electives numbered ≥4000; 3-credit minimum per course; CS 4090 and CS 4999 not allowed

One CS project course numbered ≥4000; 2-credit minimum

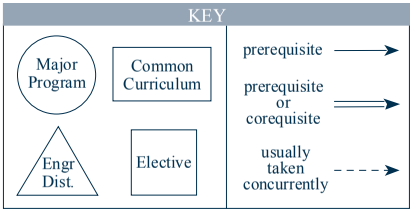
Three Major-Approved Technical Electives numbered ≥3000; 3-credit minimum per course; CS 4090 not allowed

Major-Approved Free Elective; total 3 credits

Two Advisor-approved electives; total 6 credits

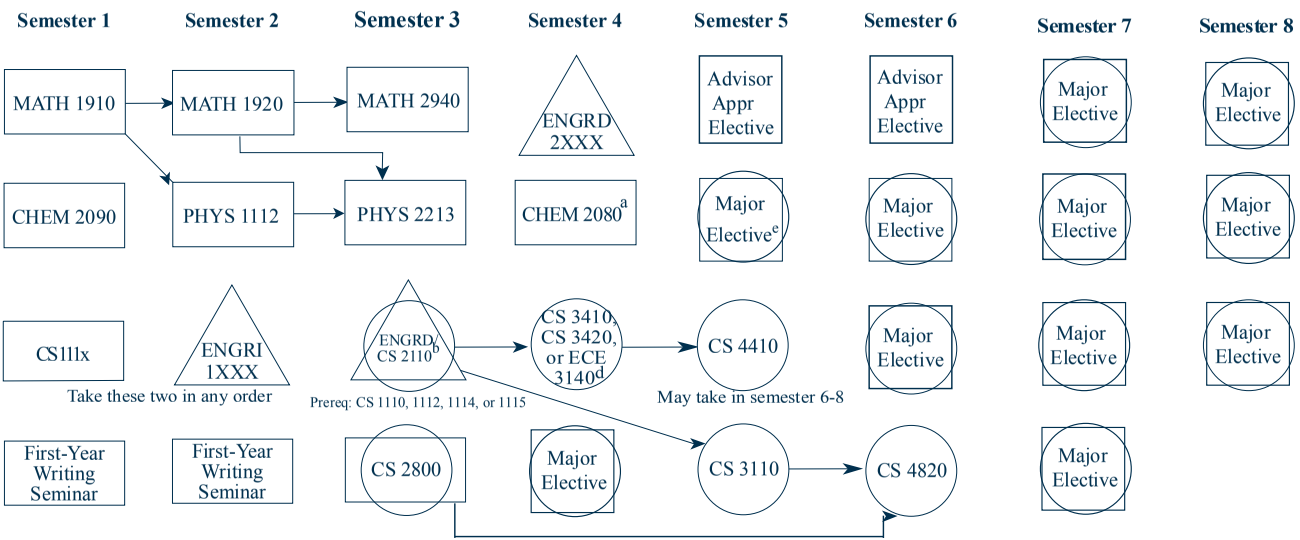
Three related, upper-level elective courses numbered ≥3000 (External Specialization); 3-credit minimum per course; CS courses not allowed

Computer Science Major (CS)



Requirements for Major Affiliation: Computer Science

At least C (not C-) in all completed CS and math courses. GPA ≥2.5 in CS 2110 (or CS 2112) and 2800. GPA ≥2.5 in MATH 1920 and CS 2800. Visit the CS undergraduate web site to learn about alternative criteria for affiliation.



Note: Liberal Studies Distribution and Physical Education requirements are not represented on this chart.

Computer Science Major Check List[f]

	Minimum Credit Hours	√ When Done
MATH 1910	4	☐
MATH 1920	4	☐
CS 2800	3	☐
MATH 2940	4	☐
CHEM 2090 (or 2150)	4	☐
CHEM 2080[a]	4	☐
PHYS 1112 (or 1116)	4	☐
PHYS 2213 (or 2217)	4	☐
CS 1110 (or 1112, or 1114, or 1115)	4	☐
Introduction to Engineering: ENGRI 1XXX	3	☐
Engineering Distribution 1: ENGRD 2110 or ENGRD 2112[b]	3	☐
Engineering Distribution 2	3	☐
First-Year Writing Seminar 1[c]	3	☐
First-Year Writing Seminar 2	3	☐
Liberal Studies Distribution: six courses, 18-credit minimum	18	
Liberal Studies 1		☐
Liberal Studies 2		☐
Liberal Studies 3		☐
Liberal Studies 4		☐
Liberal Studies 5		☐
Liberal Studies 6		☐
Advisor-approved elective 1: two courses, 6-credit minimum	6	☐
Advisor-approved elective 2		☐

Required Major Courses (47-credit minimum)

CS 3110	4	☐
CS 3410 or CS 3420 or ECE 3140[d]	4	☐
CS 4410	3	
CS 4820	4	☐
Major Electives[e]		
CS 4000 or above Elective 1[g]	3	☐
CS 4000 or above Elective 2	3	☐
CS 4000 or above Elective 3	3	
CS Project Course (4000 or above)	2	☐
External Specialization Elective 1[h]	3	☐
External Specialization Elective 2	3	☐
External Specialization Elective 3	3	☐
Major-Approved Technical Elective 1[i]	3	☐
Major-Approved Technical Elective 2	3	☐
Major-Approved Technical Elective 3	3	
Major-Approved Free Elective[j]	3	
Total Required Credits	123 minimum	

Technical Writing Course[c] ☐, Probability Requirement[k] ☐, Vector Requirement[l] ☐
Physical Education: 1 sem ☐ 2 sem ☐ swim test ☐

Notes

a. May substitute BTRY 3080, ECON 3130, MATH 2930, MATH 4710, PHYS 2214, or PHYS 2218 for CHEM 2080. MATH 2930 is a pre- or corequisite for PHYS 2214.

b. CS 2112 is an honors version of CS 2110.

c. In addition to the first-year writing seminars, a technical writing course must be taken as an engineering distribution, liberal studies, Advisor-approved elective, or Major course.

d. ECE/ENGRD 2300 is a prerequisite for ECE 3140.

e. Major electives include CS 4000+ level electives, the CS 4000+ level project course, Technical Electives, the External Specialization, and the Major-approved elective. Courses for a CS vector and the probability requirement may also be included in these categories. All Major Electives must be courses of at least 3 credits with the exception of the CS project course, which is at least 2 credits, or the Major-approved elective, which must total 3 credits.

f. This engineering checklist is formatted to conform to the general specifications of the College of Engineering. We strongly recommend that you visit 110 Gates Hall for an official Computer Science Major checklist. This information can also be obtained by visiting the Computer Science web site (www.cs.cornell.edu/undergrad).

g. All CS 4000+ Electives must be taken under the CS rubric. CS 4090 and CS 4999 NOT allowed.

h. The Major program includes nine (9) credits of courses outside the Major. These courses are satisfied by the External Specialization. The three courses must be related to each other (3000+ level and 3 credit minimum per course). Courses not allowed in the External Specialization are: any CS course, Independent Study courses, LING 4474, INFO 3300, INFO 4300, INFO 4302, and INFO 5300.

i. Three 3000+ level courses of at least 3 credits each (including ENGRD 2700 or MATH 2930, but not both) that are technical in nature, as determined by the Major. CS 4090 is not allowed. At most, two CS 4999 classes may be taken. For other independent study options, visit the CS office in 110 Gates.

j. An elective requirement consisting of a single 3+ credit course or a combination of courses coming to 3+ credits total. Roughly speaking, all academic courses (inside or outside of CS) count. No PE courses, courses numbered 10xx, or ROTC courses below the 3000 level are allowed.

k. Students' course selections must also include one of BTRY 3080, CS 4850, ECE 3100, ECON 3130, ENGRD 2700, or MATH 4710.

l. Additionally, students' course selections must satisfy the requirements of at least one "vector", or CS-centric specialization, defined by the department. The set of vectors at the time of this writing include artificial intelligence, computational science and engineering, graphics, network science, programming languages, software engineering, systems/databases, theory, and a broad "Renaissance" vector. See www.cs.cornell.edu/undergrad for the requirements of each vector.

Major: Electrical and Computer Engineering (ECE)

Accredited by ABET (see inside front cover)
Offered by: School of Electrical and Computer Engineering
222 Phillips Hall, 255.9442, www.ece.cornell.edu

Program Objectives

Our objectives are designed to serve the needs of our constituents: our graduates, the employers of our graduates, the graduate study programs that our graduates enter, and our society.

- To create leading scholars and professionals who are committed to excellence, integrity, lifelong learning, and professional citizenship.
- To enable our students to achieve engineering goals through problem solving, design, experimentation, teamwork, and effective communication.
- To endow our students with an appreciation of the impact of electrical and computer engineering on society and to encourage creative responses to the needs of society by our graduates.
- To provide our students with a broad education in the fundamentals of Electrical and Computer Engineering as well as advanced knowledge in one or more technical areas that lead to and sustain a productive engineering career.

Areas of Concentration

Computer architecture and organization, digital systems, and computer vision; power systems, and control; communications, networks, information theory and coding, signal processing, and optimization; electronic circuits, VLSI, solid state physics and devices, MEMs, nanotechnology, lasers and optoelectronics; electromagnetics, radiophysics, space sciences, and plasmas.

Engineering Distributions

ENGRD/ECE 2300: Introduction to Digital Logic Design (required)

ENGRD 2XXX[a]

Required Major Courses

ECE/ENGRD 2100: Introduction to Circuits for Electrical and Computer Engineers

ECE 2200/ENGRD 2220: Signals and Information

ECE 3400: Introduction to Design for Electrical and Computer Engineers

Further Major Requirements

At least three ECE foundation courses[c]

At least two Culminating Design Experience courses[d]

At least three additional ECE courses at the 3000-level or above

At least two breadth/depth ECE courses at the 4000-level or above[f]

At least nine credits of Outside-ECE Technical Electives

Culminating Design Experience (CDE)[d]

A Culminating Design Experience (CDE) course includes a significant and open-ended

engineering design assignment with realistic constraints. The principal goal of a CDE course is to help students develop the ability to design a component, system, or process to meet desired needs taking into account some or all of the following: economics, the environment, sustainability, manufacturability, ethics, health and safety, society, and politics. Consult the ECE Undergraduate Office for current options.

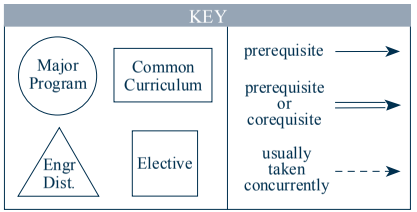
Probability Requirement: Courses that satisfy ECE Foundations Courses, the ENGRD requirement, or electives, must include at least one course with significant probability content. Please see the ECE Undergraduate Handbook for details: www.ece.cornell.edu/ece/academics/undergraduate/major/index.cfm.

Advanced Computing Requirement: Courses that satisfy ECE Foundations Courses, the ENGRD requirement, or electives, must include at least three credits of computer programming at a level above that of CS 1110 (1112, 1114, 1115), or an advanced computer engineering course at a level above ECE 3140. Please see the ECE Undergraduate Handbook for details: www.ece.cornell.edu/ece/academics/undergraduate/major/index.cfm.

Projects

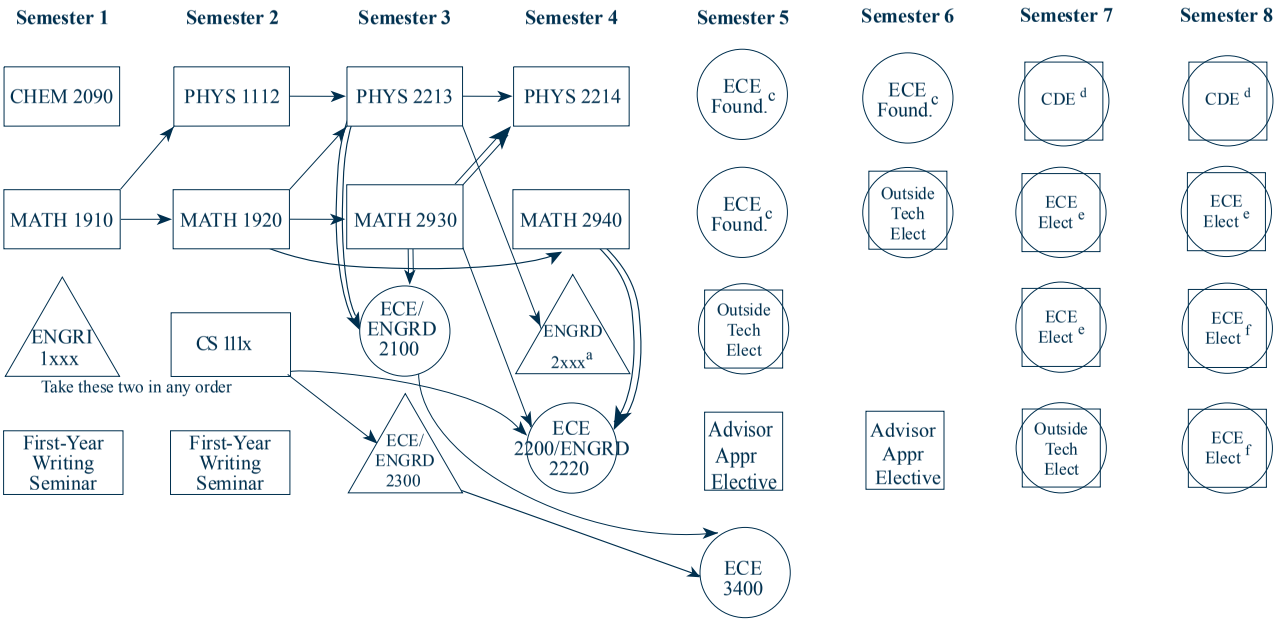
Students may count up to three credits of work on approved large-group interdisciplinary project teams in the Outside-ECE Technical Electives category. Students may also petition to count up to three independent-study credits (ECE 4999) in the Outside-ECE Technical Elective category. See the ECE Undergraduate Handbook site for rules governing such work.

Electrical and Computer Engineering Major (ECE)



Requirements for Major Affiliation: Electrical and Computer Engineering

At least C+ in MATH 2930, PHYS 2213, and one of ECE/ENGRD 2100, ECE 2200, and ECE/ENGRD 2300. GPA ≥2.5 in the following courses if completed: MATH 1920, 2930, 2940; PHYS 2213; ECE/ENGRD 2100; ECE 2200; ENGRD/CS 2110, ECE/ENGRD 2300.



Note: Liberal Studies Distribution and Physical Education requirements are not represented on this chart.

Electrical and Computer Engineering Major Check List[i]

	Minimum Credit Hours	√ When Done
MATH 1910	4	☐
MATH 1920	4	☐
MATH 2930	4	☐
MATH 2940	4	☐
CHEM 2090	4	☐
PHYS 1112 (or 1116)	4	☐
PHYS 2213 (or 2217)	4	☐
PHYS 2214 (or 2218)	4	☐
CS 1110 (or 1112, or 1114, or 1115)	4	☐
Introduction to Engineering: ENGRI 1XXX	3	☐
Engineering Distribution 1: ECE/ENGRD 2300 (required)	4	☐
Engineering Distribution 2[a]:	3	☐
First-Year Writing Seminar 1[b]	3	☐
First-Year Writing Seminar 2	3	☐
Liberal Studies Distribution: six courses, 18-credit minimum	18	
Liberal Studies 1		☐
Liberal Studies 2		☐
Liberal Studies 3		☐
Liberal Studies 4		☐
Liberal Studies 5		☐
Liberal Studies 6		☐
Advisor-approved elective 1: two courses, 6-credit minimum	6	☐
Advisor-approved elective 2		☐

Required Major Courses (55 credits)[g]

ECE 2100	4	☐
ECE 2200	4	☐
ECE 3400	4	☐
ECE Foundation Course[c]	4	☐
ECE Foundation Course	4	☐
ECE Foundation Course	4	☐
CDE[d]	4	☐
CDE[d]	4	☐
ECE 3000 + elective[e]	3	☐
ECE 3000 + elective	3	☐
ECE 3000 + elective	3	☐
ECE 4000 + breadth/depth course[f]	3	☐
ECE 4000 + breadth/depth course	3	☐
Outside–ECE Technical Elective	3	☐
Outside–ECE Technical Elective	3	☐
Outside–ECE Technical Elective	3	☐
Total Required Credits	132 minimum	

Technical Writing Course[b] ☐ Probability Requirement[h] ☐
Advanced Computing Requirement[h] ☐
Physical Education: 1 sem ☐ 2 sem ☐ swim test ☐

Notes

a. ENGRD 2110, Object Oriented Programming and Data Structures, is recommended (but not required) for those interested in the Computer Engineering specialty area.

b. In addition to the first-year writing seminars, a technical writing course must be taken as an engineering distribution, liberal studies, Advisor-approved elective, or Major course.

c. ECE Foundation Courses—At least three of the following: ECE 3030, ECE 3100, ECE 3140, ECE 3150, ECE 3250. (Must include at least one of ECE 3100 and ECE 3250, and at least one of ECE 3030 and ECE 3150.)

d Culminating Design Experience (CDE): Consult the ECE Undergraduate Office for current options. The two CDE courses taken together must have as pre-requisites at least two distinct Foundation courses, each of which a student completes prior to, or, with instructor permission, concurrently with the CDE it feeds.

e. At least three additional ECE courses at the 3000-level or above.

f. At least two additonal ECE courses numbered 4000-level or above. Each of these courses must have as a pre-requisite at least one Foundation Course that a student completes prior to, or, with instructor permission, concurrently with the breadth/depth course it feeds. The list of completed pre-requisites for the breadth/depth courses taken together must include at least two distinct Foundation Courses. The list of completed pre-requisites for the CDE and breadth/depth courses taken together must include at least three distinct Foundation Courses. Students must include among these three distinct Foundation Courses at least one of ECE 3100 and ECE 3250 and at least one of ECE 3030 and ECE 3150.

g. The Major program includes nine (9) credits of courses outside the Major. These are satisfied by the outside-ECE Technical Electives.

h. The Probability and Advanced Computing requirements are typically satisfied by courses that simultaneously count as Foundation Courses, Engineering Distribution courses, or electives. Please see the ECE Undergraduate Handbook for details: www.ece.cornell.edu/ece/academics/undergraduate/major/index.cfm.

i. We recommend strongly that you obtain from 222 Phillips Hall or the ECE Undergraduate Handbook web site (www.ece.cornell.edu/ece/academics/undergraduate/major/index.cfm) an official ECE Graduation Checklist appropriate for the Class of 2018 or later.

Major: Engineering Physics (EP)

Offered by: School of Applied and Engineering Physics
261 Clark Hall, 255.0638, www.aep.cornell.edu

Program Objectives

The objectives for the Major in Engineering Physics are to:

- Give students an adequate education in mathematics and physics so they have a basis for a complete understanding of current and future scientific and technological developments.
- Ensure, through a set of several elective courses, the necessary flexibility for various career objectives, i.e. (1) immediate employment with the B.S. degree; (2) background for entering professional graduate schools like law or medicine; or (3) the appropriate background for Ph.D. graduate work in science and/or engineering.
- Include throughout the undergraduate program hands-on experience in laboratory as well as design, computational, and research problems.
- Provide an environment characterized by the highest academic and ethical standards that instills pride in these standards and the program in general.

Introduction to Engineering Course

ENGRI 1XXX: Introduction to Engineering Course

Engineering Distributions (suggested)[a,b]

ENGRD 2520: The Physics of Life

ENGRD 2640: Interfacing the Digital Domain with an Analog World

ENGRD XXXX: Choose from the list of engineering distribution courses;
AEP 3330: Mechanics of Particles and Solid Bodies may count as the second engineering distribution course for EP Majors.

Required Major Courses

AEP 4210–4220: Mathematical Physics I and II

AEP 3330[b]: Mechanics of Particles and Solid Bodies (counts as an engineering distribution course)

AEP 3550: Intermediate Electromagnetism

AEP 3610: Introductory Quantum Mechanics

AEP 3630[d]: Electronic Circuits (Laboratory)

AEP 4230: Statistical Thermodynamics

PHYS 4410[e]: Advanced Experimental Physics (Laboratory)

Further Major Requirements

Choose 2 of the 3 courses below:

AEP 3560: Intermediate Electrodynamics

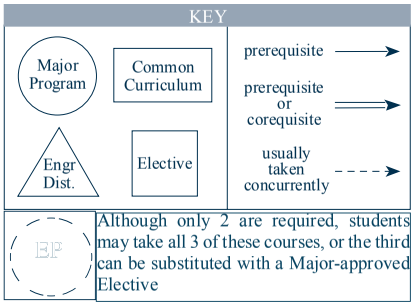
AEP 3620: Intermediate Quantum Mechanics

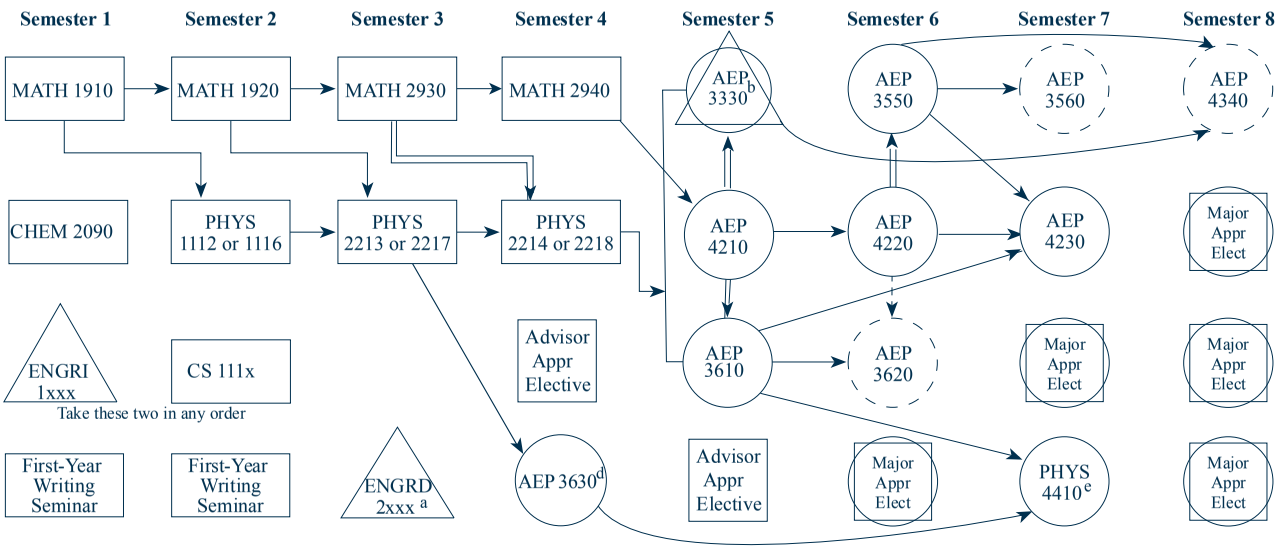
AEP 4340: Fluid and Continuum Mechanics

Engineering Physics Major (EP)

Requirements for Major Affiliation: Engineering Physics

Must score at least B– in all required math and physics courses (MATH 1910, MATH 1920, MATH 2930, MATH 2940, PHYS 1112/1116, PHYS 2213/2217, PHYS 2214/2218).





Note: Liberal Studies Distribution and Physical Education requirements are not represented on this chart.

Engineering Physics Major Check List

	Minimum Credit Hours	√ When Done
MATH 1910	4	☐
MATH 1920	4	☐
MATH 2930	4	☐
MATH 2940	4	☐
CHEM 2090 (or 2150)	4	☐
PHYS 1112 (or 1116)	4	☐
PHYS 2213 (or 2217)	4	☐
PHYS 2214 (or 2218)	4	☐
CS 1110 (or 1112, or 1114, or 1115)	4	☐
Introduction to Engineering: ENGRI 1XXX	3	☐
Engineering Distribution 1: ENGRD 2640 or 2520 (recommended)[a]	3	☐
Engineering Distribution 2: AEP 3330 (recommended)[b]	3	☐
First-Year Writing Seminar 1[c]	3	☐
First-Year Writing Seminar 2	3	☐
Liberal Studies Distribution: six courses, 18-credit minimum	18	
Liberal Studies 1		☐
Liberal Studies 2		☐
Liberal Studies 3		☐
Liberal Studies 4		☐
Liberal Studies 5		☐
Liberal Studies 6		☐
Advisor-approved elective 1: two courses; 6-credit minimum	6	☐
Advisor-approved Elective 2		☐

Required Major Courses (58-credit minimum)

AEP 4210	4	☐
AEP 4220	4	☐
AEP 3330	4	☐
AEP 3550	4	☐
AEP 3560[d]	4	☐
AEP 3610	4	☐
AEP 3620[d]	4	☐
AEP 3630[e]	4	☐
AEP 4230	4	☐
AEP 4340[d]	4	☐
PHYS 4410[f]	4	☐
Major-approved Elective[g]	3	☐
Major-approved Elective	3	☐
Major-approved Elective	3	☐
Major-approved Elective	3	☐
Major-approved Elective	3	☐
Major-approved Elective	3	☐
Total Required Credits	133 minimum	
Technical Writing Course[c]: ENGRD 2640 (recommended)		☐

Physical Education: 1 sem ☐ 2 sem ☐ swim test ☐

Notes

a. EP offers two ENGRDs. ENGRD 2640 (recommended, but not required; satisfies the college technical writing requirement) offered in fall and spring, and ENGRD 2520, offered in spring.

b. AEP 3330 may simultaneously satisfy major and distribution requirements. In this case, the total number of credits required for the degree is 130.

c. In addition to the first-year writing seminars, a technical writing course must be taken as an engineering distribution, liberal studies, Advisor-approved elective, or Major course. (ENGRD 2640 satisfies this requirement.)

d. Students are required to take two out of the following three courses: AEP 3560, AEP 3620, AEP 4340.

e. AEP 3630 may be taken in either semester three or four. ECE 2100 and ECE 2300 can be substituted for AEP 3630.

f. Two of the four credits of PHYS 4410 can be satisfied by successfully completing AEP 3300/PHYS 3330 or ASTRO 4410. The remaining two credits can be satisfied by taking PHYS 4400 for two credits, provided that the experiments in PHYS 4400 do not overlap with those in AEP 3300/PHYS 3330 or ASTRO 4410. If a student chooses this option, the remaining Major-approved electives must have enough credit hours such that the EP minimum of 58 is satisfied.

g. Six Major-approved electives:
   (1) Five of the six must be technical courses at or above the 3000-level.
   (2) Nine credits of Major-approved electives must be outside of EP.
   (3) Only three independent study courses may be taken as Major-approved electives, and must be taken during the last four semesters.
   (4) All Major-approved electives must be taken for a letter grade (C- or better).

Major: Environmental Engineering (EnvE)

Accredited by ABET (see inside front cover)
Offered jointly by:
Department of Biological and Environmental Engineering
207 Riley-Robb Hall, 607.255.2173, www.enve.cornell.edu
and
School of Civil and Environmental Engineering
221 Hollister Hall, 607.255.3412, www.enve.cornell.edu

Program Objectives

We are committed to providing an excellent undergraduate engineering program in a nurturing learning environment so that our graduates acquire knowledge and develop the skills needed for successful professional careers. The educational program objectives are to:

- Produce graduates who pursue careers in Environmental Engineering based on a background in mathematics, physical and life sciences, liberal studies, and engineering.
- Produce graduates who pursue advanced degrees in engineering and related professional fields.
- Produce graduates who assume leadership positions and contribute to solution of societal problems involving environmental systems.

The Civil Engineering major offers a focus in Environmental Engineering. The Biological Engineering Major offers focus areas in Ecological and Microbial Systems, and Sustainability.

Introduction to Engineering

BEE 1200: The BEE Experience (required for students matriculating in CALS)[c], *or*
ENGRI 1XXX: Introduction to Engineering (ENGRI 1130 is recommended.)

Engineering Distributions

BEE/ENGRD 2510: Engineering Processes for Environmental Sustainability (required)

ENGRD 2XXX: ENGRD 2020: Mechanics of Solids, *or*
ENGRD 2210: Thermodynamics, *or*
ENGRD 3200: Engineering Computation are recommended[d]

Required Major Courses

Introductory Biology (choose one):

BIOEE 1610: Ecology and the Environment, *or*

BIOEE 1780: Evolutionary Biology and Diversity, *or*
BIOG 1440: Comparative Physiology, *or*
BIOG 1445: Comparative Physiology, Personalized Instruction, *or*
BIOMG 1350: Cell and Development Biology

ENGRD 2020: Mechanics of Solids[d]

ENGRD 2210: Thermodynamics[d], *or*
ENGRD 3200: Engineering Computation[d], *or*
BEE 2220: Bioengineering Thermodynamics and Kinetics

CEE 3040: Uncertainty Analysis in Engineering[h]

CEE 3230: Engineering Economics and Management, *or*
BEE 4890: Entrepreneurial Management for Engineers

CEE 3310: Fluid Mechanics

CEE 3510: Environmental Quality Engineering

CEE 4510: Microbiology for Environmental Engineering[i]

BEE 4750: Environmental Systems Analysis

Earth Science[j]

Laboratory Course[j]

Electives[j]

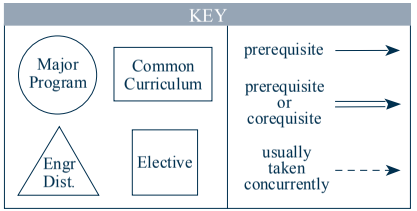
Three Environmental Design electives, 9 credit minimum

Two Major-approved electives

Technical writing course[e]

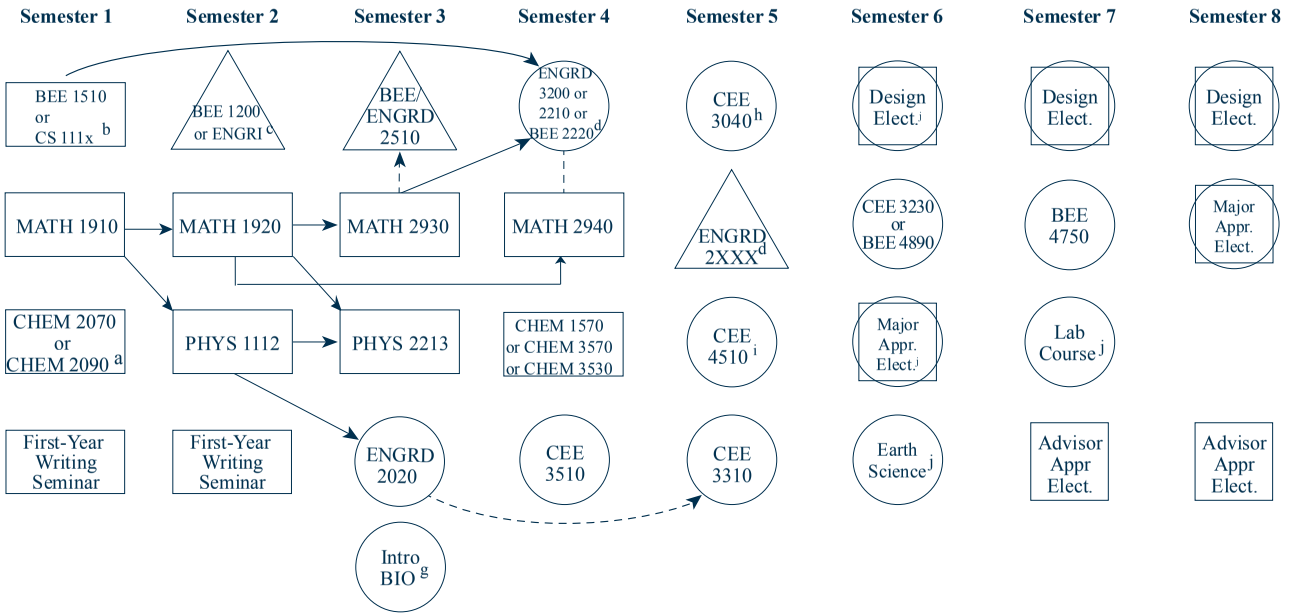
Two Advisor-approved electives

Environmental Engineering Major (EnvE)



Requirements for Major Affiliation: Environmental Engineering

GPA ≥2.0 for all engineering and science courses. At least C– in BEE/ENGRD 2510.



Note: Liberal Studies Distribution and Physical Education requirements are not represented on this chart.

Environmental Engineering Major Check List

	Minimum Credit Hours	√ When Done
MATH 1910	4	☐
MATH 1920	4	☐
MATH 2930	4	☐
MATH 2940	4	☐
CHEM 2090 or CHEM 2070 (or 2150)[a]	4	☐
CHEM 1570 or 3570 or 3530	3	☐
PHYS 1112 (or 1116)	4	☐
PHYS 2213 (or 2217)	4	☐
CS 1110 (or 1112, or 1114, or 1115) or BEE 1510[b]	4	☐
Introduction to Engineering: ENGRI 1XXX or BEE 1200[c]	3/1	☐
Engineering Distribution 1: BEE/ENGRD 2510 (required)	3	☐
Engineering Distribution 2: ENGRD XXXX[d]	3	☐
First-Year Writing Seminar 1[e]	3	☐
First-Year Writing Seminar 2	3	☐
Liberal Studies Distribution: six courses, 18-credit minimum	18	
Liberal Studies 1		☐
Liberal Studies 2		☐
Liberal Studies 3		☐
Liberal Studies 4		☐
Liberal Studies 5		☐
Liberal Studies 6		☐
Advisor-approved Elective 1: 2 courses, 6-credit minimum	6	
Advisor-approved Elective 2		☐

Required Major Courses (51-credit minimum)[f]

Intro BIO 1XXX[g]	3/4	☐
ENGRD 2020	4	☐
ENGRD 3200 or 2210 or BEE 2220	3/4	☐
CEE 3040[h]	4	☐
CEE 3230 or BEE 4890	3/4	☐
CEE 3310	4	☐
CEE 3510	3	☐
CEE 4510[i]	3	☐
BEE 4750	3	☐
Earth Science[j]	3	☐
Laboratory Course[j]	3	☐
Design Elective 1 (Approved Capstone)[j]	3	☐
Design Elective 2	3	☐
Design Elective 3	3	☐
Major-approved Elective 1[j]	3	☐
Major-approved Elective 2	3	☐
Engineering electives (if needed)[c]	0–3	☐
Total Required Credits	125 minimum[k]	
Technical Writing Course[e]		☐

Physical Education: 1 sem ☐ 2 sem ☐ swim test ☐

Notes

a. Engineering matriculates must enroll in CHEM 2090 (fall, spring); CALS matriculates must enroll in CHEM 2070 (fall). Students in either college may substitute CHEM 2150 for CHEM 2090 or CHEM 2070.

b. Students matriculated in CALS may take BEE 1510 for the computing requirement. Engineering students take CS 1110, 1112, 1114, or 1115.

c. BEE 1200 combined with BEE 1510: Introduction to Computer Programming (5 credits total) satisfies the ENGRI requirement for CALS matriculated students. Students using BEE 1200 and BEE 1510 to satisfy the ENGRI requirement must make up the 2-credit deficit with other engineering course work.

d. ENGRD 2020 (fall, spring, summer), and 2210 (fall) or 3200 (spring) are recommended. Students electing to use one of these courses as a second engineering distribution must take an additional Major-approved elective.

e. In addition to the First-Year Writing Seminars, a technical writing course must be taken as an engineering distribution, liberal studies, Advisor-approved elective or Major course. An approved COMM or ENGRC course, or BEE 4730, or BEE 4890, will satisfy this requirement. Students meeting the technical communications requirement with a course that fulfills another requirement (e.g. liberal studies, Lab, Design) can use that one course to satisfy both requirements.

f. The Major program includes nine (9) credits of courses outside the Major.

g. Choose one of the following biology courses: BIOEE 1610, BIOEE 1780, BIOG 1440, BIOG 1445, BIOMG 1350, BIOSM 1610, or BIOSM 1780. Complete before semester 5.

h. ENGRD 2700: Basic Engineering Probability and Statistics is accepted (by petition) to substitute for CEE 3040 if taken prior to affiliation with Environmental Engineering, or if necessary because of scheduling conflicts caused by co-op or study abroad programs.

i. Students may take BIOMI 2900: General Microbiology Lectures, in place of CEE 4510.

j. The lists of acceptable courses for an earth science, laboratory, design, and Major-approved elective are published in the *Undergraduate Handbook for Environmental Engineering.* At least one design elective must be chosen from the list of Capstone design courses. The handbook is available online (enve.cornell.edu), in 207 Riley-Robb Hall, and in 221 Hollister Hall.

k. Must include at least 57 credits of engineering courses (including distribution courses).

Major: Information Science, Systems, and Technology (ISST)

Offered by: Department of Information Science
110H Gates Hall, 255.9837, www.infosci.cornell.edu/academics/degrees/bs-engineering
and
School of Operations Research and Information Engineering
(Management Science Option)
202 Rhodes Hall, 255.5088, www.infosci.cornell.edu/academics/degrees/bs-engineering

Program Objectives

The ISST Major studies the design and management of complex information systems. Rather than focusing on the computing and communication technologies that underlie digital information systems, the ISST Major emphasizes information systems engineering in broad application contexts, where issues at the confluence of information science, technology, and management are the primary concerns. The core courses in the field provide students with grounding in operations research modeling techniques of probability, statistics, and optimization; computer science; economics; and the social and organizational contexts in which transformative information systems exist. Students then choose one of two options: Management Science (MS) or Information Science (IS).

The Management Science option educates students in methods for quantitative decision-making and their application to information technology, as well as the broader role that information technology plays in making these methods effective. Management Science students take advanced courses in mathematical models in management science, information systems, mathematical modeling in IT, and information technology management solutions.

The Information Science option educates students in methods for the creation, representation, organization, access, and analysis of information in digital form. Students who choose the Information Science option take classes in information systems, mathematical modeling in IT, human-centered systems, and social systems.

Note: All courses used toward the ISST Major must be taken for a letter grade.

The Major requires ENGRD 2700: Basic Engineering Probability and Statistics as an engineering distribution course. CS 2110 is required by the Major and it is recommended that it be taken as an engineering distribution course.

The Major has seven (7) additional required courses in three areas: probability, statistics, optimization (two courses); information systems (three courses); and economic, organizational, and social context (two courses).

Students then complete the Major by specializing in either the Management Science option or the Information Science option (seven advanced courses); and by taking two Major-approved electives. The set of Major-approved elective courses is the same for both specialization options, and it contains all the courses listed at infosci.cornell.edu/academics/degrees/bs-engineering/degree-requirements/specializations-course-requirements. In addition, students may choose to take INFO 4900: Independent Reading and Research, as one of their Major-approved elective courses, as discussed at the web site noted above.

Engineering Distributions

ENGRD 2110: Object-Oriented Programming and Data Structures (required by the Major; recommended as a distribution course)

ENGRD 2700: Basic Engineering Probability and Statistics (required)

Required Major Courses

INFO 2040: Networks[f]

INFO 2300: Intermediate Design and Programming for the Web

INFO 2450: Communication and Technology *or*
ENGRC 3350: Communications for Engineering Managers

INFO 3300: Data-Driven Web Applications *or*
INFO 4300: Language and Information

ORIE 3300: Optimization I
ORIE 3500: Engineering Probability and Statistics II

ORIE 3800: Information Systems and Analysis

Information Science Option

Three courses from Area II: Information Systems

One course from Area III: Mathematical Modeling in Information Technology

Three elective courses: Students must choose either Area V: Human-Centered Systems or Area VI: Social Systems and take all elective courses from that area.

Management Science Option

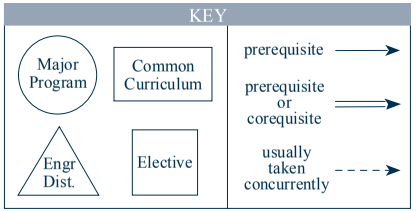
The four courses in Area I: Mathematical Models in Management Science

Three elective courses:

- one from Area II: Information Systems
- two from the union of Area III: Mathematical Modeling in Information Technology and Area IV: Information Technology Management Solutions

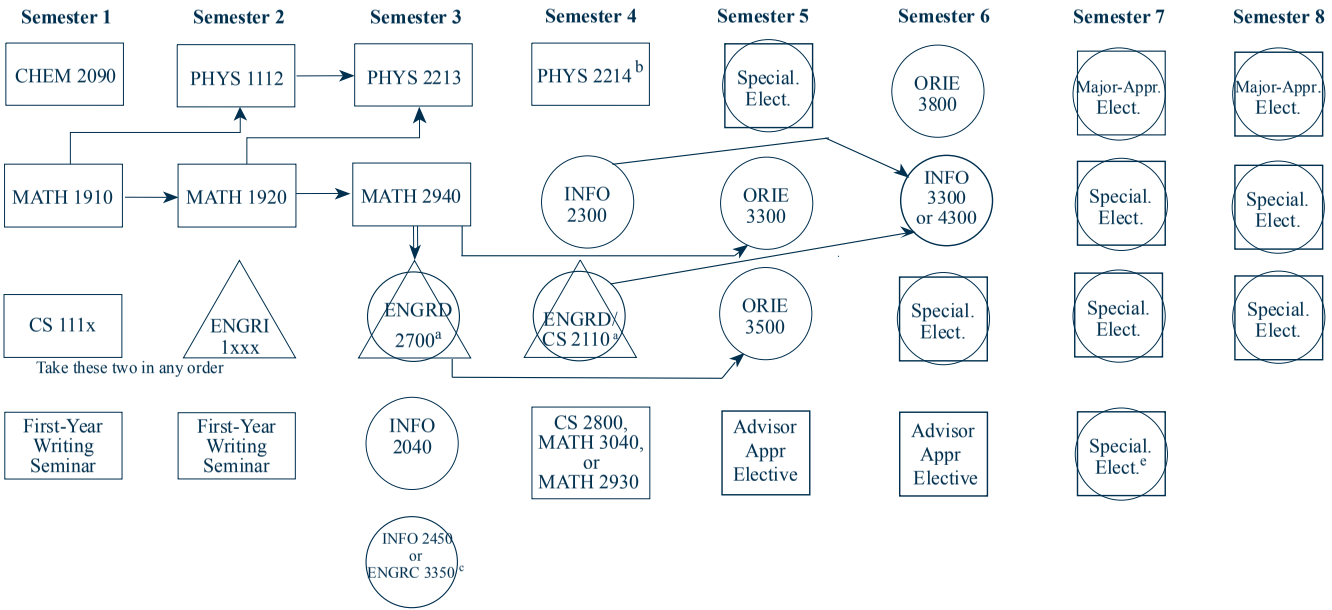
For a complete listing of course options for Areas I-VI, visit www.infosci.cornell.edu/academics/degrees/bs-engineering/degree-requirements/specializations-course-requirements.

Information Science, Systems, and Technology Major (ISST)



Requirements for Major Affiliation: Information Science, Systems, Technology

At least C in two of MATH 2940, CS 2110, and ENGRD 2700. GPA ≥2.3 in completed math, ENGRD, and ISST Major courses. Qualifying courses must be taken at Cornell, and for a letter grade. For a repeated course, the most recent grade is used. New majors are required to take at least two core major classes the first semester after they affiliate with the program.



Note: Liberal Studies Distribution and Physical Education requirements are not represented on this chart.

Information Science, Systems, and Technology Check List

	Minimum Credit Hours	√ When Done
MATH 1910	4	☐
MATH 1920	4	☐
MATH 2930 (or 3040 or CS 2800)	3/4	☐
MATH 2940	4	☐
CHEM 2090 (or 2150)	4	☐
PHYS 1112 (or 1116)	4	☐
PHYS 2213 (or 2217)	4	☐
PHYS 2214[b]	3/4	☐
CS 1110 (or 1112, or 1114, or 1115)	4	☐
Introduction to Engineering: ENGRI 1XXX	3	☐
Engineering Distribution 1: ENGRD 2700[a]	3	☐
Engineering Distribution 2: CS/ENGRD 2110[a]	3	☐
First-Year Writing Seminar 1[c]	3	☐
First-Year Writing Seminar 2	3	☐
Liberal Studies Distribution: six courses, 18-credit minimum	18	
Liberal Studies 1		☐
Liberal Studies 2		☐
Liberal Studies 3		☐
Liberal Studies 4		☐
Liberal Studies 5		☐
Liberal Studies 6		☐
Advisor-approved elective 1: two courses, 6-credit minimum	6	☐
Advisor-approved elective 2		☐

Required Major Courses (52-credit minimum)[d,g]

INFO 2040[f]	4	☐
INFO 2300	3	☐
INFO 2450 or ENGRC 3350[c]	3	☐
INFO 3300 or INFO 4300	3	☐
ORIE 3300	4	☐
ORIE 3500	4	☐
ORIE 3800	4	☐
Information Science/Management Science Option (nine course, 27-credit minimum)[e]		
Specialization Elective	3/4	☐
Specialization Elective	3/4	☐
Specialization Elective	3/4	☐
Specialization Elective	3/4	☐
Specialization Elective	3/4	☐
Specialization Elective	3/4	☐
Specialization Elective	3/4	☐
Major-approved Elective	3/4	☐
Major-approved Elective	3/4	☐
Total Required Credits	125 minimum	

Technical Writing Course[c]: ENGRC 3350 (recommended)

Physical Education: 1 sem ☐ 2 sem ☐ swim test ☐

Notes

a. CS/ENGRD 2110 and ENGRD 2700 are required by the Major, and it is recommended that these courses be used as engineering distribution courses.

b. The following courses may be substituted for PHYS 2214, if not used to meet other requirements: PHYS 2218, CHEM 2080, CHEM 2160, MATH 2930, MATH 3040, or CS 2800. Math 2930 is a pre- or corequisite for PHYS 2214.

c. In addition to the first-year writing seminars, a technical writing course must be taken as an engineering distribution, liberal studies, Advisor-approved elective, or Major course. ENGRC 3350 is recommended as a technical writing course for ISST Majors.

d. The program includes nine (9) credits of courses outside the Major department. This is satisfied by the interdisciplinary nature of the ISST Major.

e. Major electives include seven (7) Specialization courses in either Information Science or Management Science, and two Major-approved electives chosen from Areas I-VI of the Major. Please see www.infosci.cornell.edu/ugrad/ for more information.

f. It is recommended that INFO 2040 be taken in semester three; however, students may elect to move the class to semester five and take INFO 1300 as an Advisor-approved elective in preparation for taking INFO 2300 in their fourth semester. Note: It is highly recommended, but not required, that INFO 1300 be taken prior to INFO 2300.

g. New majors are required to take at least two core Major classes the first semester after they affiliate with the program.

This engineering check list is formatted to conform to the general specifications of the College of Engineering. We strongly recommend that you visit 110H Gates Hall for an official ISST Major check list. This information can also be obtained by visiting the Information Science web site (www.infosci.cornell.edu/academics/degrees/bs-engineering).

Major: Materials Science and Engineering (MSE)

Accredited by ABET (see inside front cover)
Offered by: Department of Materials Science and Engineering
210 Bard Hall, 255.9159, www.mse.cornell.edu

Program Objectives

The MSE undergraduate Major is based on the following educational objectives:

- Preparation: To prepare students to excel in graduate school or technical careers through a world-class, rigorous, and competitive program.
- Core Competence: To train students across the spectrum of basic and applied materials science, recognizing and exploiting common descriptions in disparate systems.
- Breadth: To train students with sufficient scientific and engineering breadth to design and create novel solutions to materials problems in engineering systems.
- Professionalism: To develop in students professional and ethical attitudes, effective communication and teamwork skills, and an ability to place science and engineering issues and solutions within the broader societal context.
- Learning Environment: To provide students with an academic environment committed to excellence and innovation that contributes to developing leadership, professionalism, and life-long learning for their professional careers.

Common Curriculum Recommendations

CHEM 2090: Engineering General Chemistry

Engineering Distributions

ENGRD 2610: Mechanical Properties of Materials: From Nanodevices to Superstructures

ENGRD 2620: Electronic Materials for the Information Age

Either course (ENGRD 2610 or 2620) satisfies the Major entry requirement.

Other Relevant Engineering Distributions

ENGRD 2020: Mechanics of Solids

ENGRD 2100: Introduction to Circuits for Electrical and Computer Engineers

ENGRD 2202: Biomedical Transport Phenomenon

ENGRD 2520: The Physics of Life

ENGRD 2600: Principles of Biological Engineering

ENGRD 2640: Computer-Instrumentation Design

ENGRD 2700: Basic Engineering Probability and Statistics

ENGRD 3200: Engineering Computation

Required Major Courses

MSE 2060: Atomic and Molecular Structure of Matter

MSE 2610: Mechanical Properties of Materials: From Nanodevices to Superstructures (required unless used as Engineering Distribution)

MSE 2620: Electronic Materials for the Information Age (unless used as engineering distribution)

MSE 3010: Materials Chemistry

MSE 3030: Thermodynamics of Condensed Systems

MSE 3040: Kinetics, Diffusion, and Phased Transformations

MSE 3050: Electronic, Magnetic, and Dielectric Properties of Materials

MSE 3070: Materials Design Concepts I[c]

MSE 3110–3120: Junior Laboratory I and II

MSE 4020: Mechanical Properties of Materials, Processing, and Design

MSE 4030: Senior Materials Laboratory I[d]

MSE 4070: Materials Design Concepts II

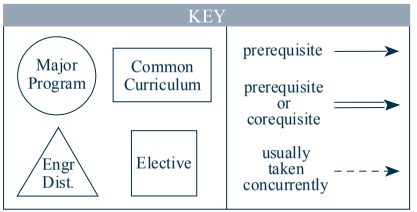
Electives[g]

Two materials-related electives covering two groups of different materials.[b,e]

Three materials application–related electives in at least two different types of applications. Two of the materials application-related electives must be taken from outside MSE.[b,e]

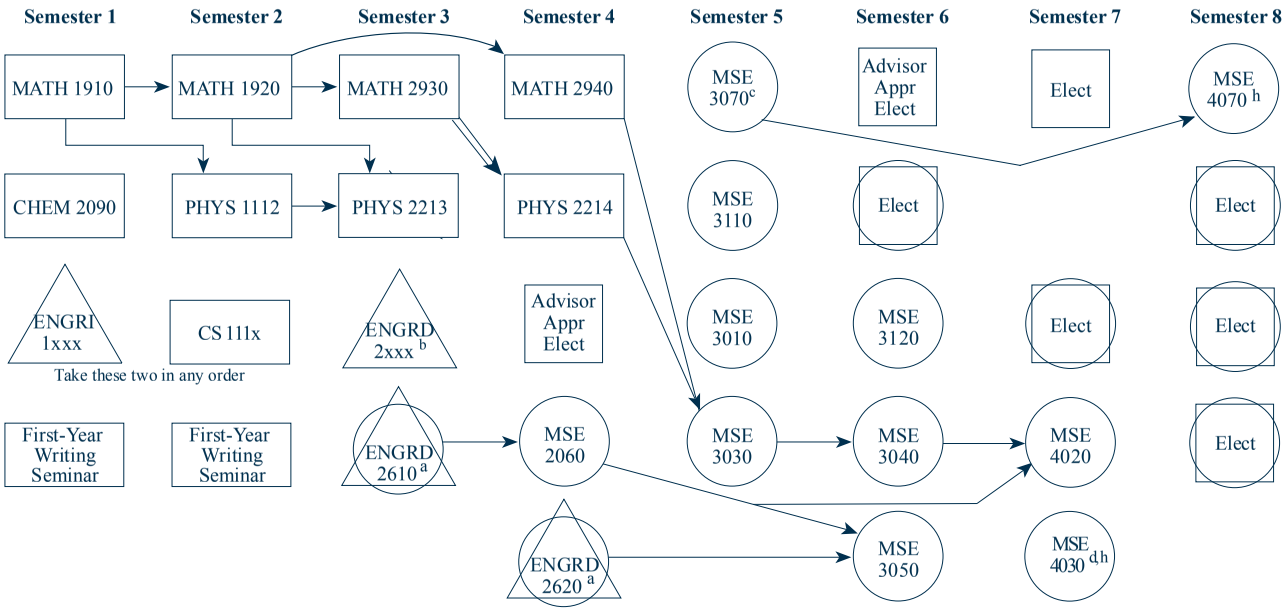
One additional technical elective must be taken from outside MSE.[f]

Materials Science and Engineering Major (MSE)



Requirements for Major Affiliation: Materials Science and Engineering

Cumulative GPA ≥2.0 in the required math, physics, and chemistry courses and at least C in ENGRD 2610 or 2620. Alternatively, at least B- in the following: MATH 2930, PHYS 2213, CHEM 2090, and ENGRD 2610 or 2620.



Note: Liberal Studies Distribution and Physical Education requirements are not represented on this chart.

Materials Science and Engineering Major Check List

	Minimum Credit Hours	√ When Done
MATH 1910	4	☐
MATH 1920	4	☐
MATH 2930	4	☐
MATH 2940	4	☐
CHEM 2090 (or 2150)	4	☐
PHYS 1112 (or 1116)	4	☐
PHYS 2213 (or 2217)	4	☐
PHYS 2214 (or 2218)	4	☐
CS 1110 (or 1112, or 1114, or 1115)	4	☐
Introduction to Engineering: ENGRI 1XXX	3	☐
Engineering Distribution 1: ENGRD 2610 or 2620[a]	3	☐
Engineering Distribution 2: ENGRD 2XXX[b]	3	☐
First Year Writing Seminar 1[c]	3	☐
First Year Writing Seminar 2	3	☐
Liberal Studies Distribution: six courses,18-credit minimum	18	
Liberal Studies 1		☐
Liberal Studies 2		☐
Liberal Studies 3		☐
Liberal Studies 4		☐
Liberal Studies 5		☐
Liberal Studies 6		☐
Advisor-approved elective 1: two courses, 6-credit minimum	6	☐
Advisor-approved elective 2		☐

Required Major Courses (54-credit minimum)[g]

MSE 2610 or MSE 2620	3	☐
MSE 2060	3	☐
MSE 3010	3	☐
MSE 3030	4	☐
MSE 3040	4	☐
MSE 3050	3	☐
MSE 3070	3	☐
MSE 3110	2	☐
MSE 3120	2	☐
MSE 4020	3	☐
MSE 4030[d,h]	4/6	☐
MSE 4070[h]	3	☐
Materials-related Elective I[e]	3	☐
Materials-related Elective II	3	☐
Materials Application-related MSE Elective I[e]	3	☐
Materials Application-related non–MSE Elective II	3	☐
Materials Application-related non–MSE Elective III	3	☐
Non–MSE Technical Elective III[f]	3	☐
Total Required Credits	130 minimum	
Technical Writing Course[c]		☐

Physical Education: 1 sem ☐ 2 sem ☐ swim test ☐

Notes

a. ENGRD 2610 or 2620 satisfies the Major entry requirement.

b. In addition to Major requirements, a course involving significant computational or mathematical modeling or advanced mathematics is required. This requirement is typically fulfilled by one of the Engineering Distribution, Advisor-approved elective, Materials-related Elective, or outside Technical Elective courses. Courses satisfying this requirement will generally have MATH 2930, MATH 2940, or equivalent courses as a pre- or co-requisite. A partial list of courses meeting this requirement is available in the MSE office and online at www.mse.cornell.edu.

c. In addition to the first-year writing seminars, a technical writing course must be taken as an engineering distribution, liberal studies, Advisor-approved elective, or Major course. The combination of MSE 3070/4070 with MSE 4030/4060 satisfies this requirement.

d. Research-oriented students may replace MSE 4030 (senior lab) with MSE 4050 and 4060 (senior thesis).

e. A list of approved materials electives and a partial list of materials application-related courses are available in the MSE office and online at www.mse.cornell.edu.

f. The non-MSE Technical Elective must be an upper level (2000+) technical course and may be selected from engineering or other colleges subject to advisor approval.

g. The Major program includes nine (9) credits of courses outside the Major. These are satisfied by the non-MSE Technical Elective and by six (6) credits of the materials application-related electives.

h. In the fall, students may substitute MSE 5070 for MSE 4070.

Major: Mechanical Engineering (ME)

Accredited by ABET (see inside front cover)
Offered by: The Sibley School of Mechanical and Aerospace Engineering
108 Upson Hall, 255.3573, www.mae.cornell.edu

Program Objectives

Cornell University is a learning community that seeks to serve society by educating the leaders of tomorrow and extending the frontiers of knowledge. The faculty and staff of the Sibley School of Mechanical and Aerospace Engineering, as members of this community, affirm these objectives. Specifically, the Sibley School is committed to excellence and seeks to graduate mechanical engineers who, collectively:

- assume leadership positions in technology-based industries;
- conceive, design, and realize useful products, systems, and services, properly respecting economic, environmental, cultural, life-safety, and ethical standards or constraints;
- discover and apply new knowledge and develop new tools for the practice of engineering;
- complete programs of graduate and/or professional studies and continue to learn throughout their lives;
- are valued in their careers, whether for mastery of the disciplines central to mechanical engineering or for the broader analytical or creative abilities fostered by their engineering education; and
- engage with their communities, profession, and the world.

These Program Educational Objectives describe long-term accomplishments for which we seek to prepare our graduates. Progress toward these objectives is expected to be measurable within three to five years of graduation.

Engineering Distributions

ENGRD 2020: Statics and Mechanics of Solids (required)[b]

Required Major Courses

ENGRD 2210: Thermodynamics[b]

MAE 2030: Dynamics

MAE 2250: Mechanical Synthesis

MAE 3230: Introductory Fluid Mechanics

MAE 3240: Heat Transfer

MAE 3260: System Dynamics

MAE 3270: Mechanics of Engineering Materials

MAE 3272: Mechanical Property and Performance Laboratory

MAE 3280: Experimental and Applied Mechanics of Structures

MAE 3780: Mechatronics (recommended) *or*
ENGRD 2100: Introduction to Circuits for Electrical and Computer Engineers *or*
PHYS 3360: Electronic Circuits

MAE 4272: Fluids/Heat Transfer Laboratory[c,f]

MAE 4300: Professional Practice in Mechanical Engineering[f]

Major-approved electives

MAE 4xx1: Supervised Senior Design Experience[f,g]

Mathematics Elective: MAE 3100: Introduction to Applied Mathematics I; or ENGRD 2700: Basic Engineering Probability and Statistics; or CEE 3040: Uncertainty Analysis in Engineering; or ENGRD 3200: Engineering Computation[a,h]

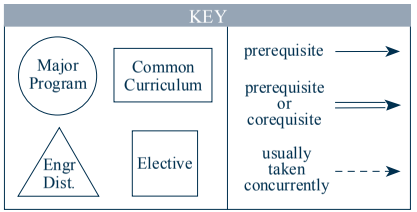
Technical Elective[i,a]

Major-approved electives (two courses)[e]

The upper-level common curriculum (Advisor-approved electives) and the Major-approved electives can be used to build a program with particular emphasis for individual students, appropriate for a wide range of career objectives, including supervised engineering practice, advanced professional engineering education, and other professional education (business, medicine, law).[a]

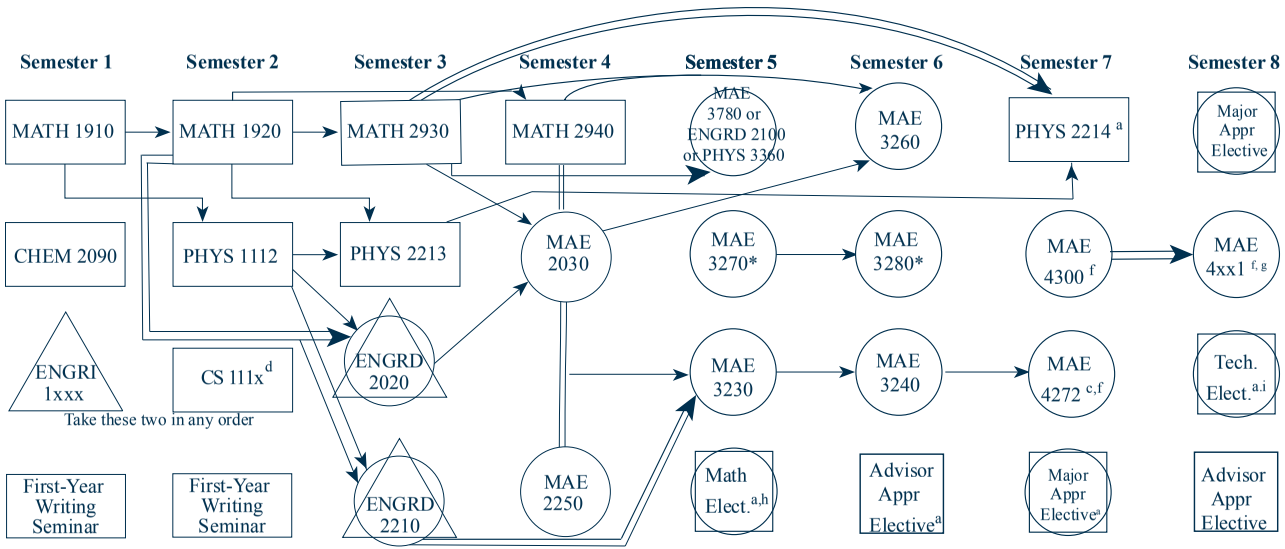
For a complete list of designated senior design courses and guidelines for electives, consult: www.mae.cornell.edu.

Mechanical Engineering Major (ME)



Requirements for Major Affiliation: Mechanical Engineering

At least C– in ENGRD 2020 and all completed required math, science, and computer science courses. (ENGRD 2210 is recommended prior to affiliation.) GPA ≥2.5 in these courses: MATH 2930, PHYS 2213, ENGRD 2020, and ENGRD 2210 (if taken).



Notes:

*MAE 3270 and MAE 3280 will be available starting 2017-2018.

Liberal Studies Distribution and Physical Education requirements are not represented on this chart.

Mechanical Engineering Major Check List

	Minimum Credit Hours	√ When Done
MATH 1910	4	☐
MATH 1920	4	☐
MATH 2930	4	☐
MATH 2940	4	☐
CHEM 2090 (or 2150)	4	☐
PHYS 1112 (or 1116)	4	☐
PHYS 2213 (or 2217)	4	☐
PHYS 2214 (or 2218)[a]	4	☐
CS 1112 (or 1110, or 1114, or 1115)[d]	4	☐
Introduction to Engineering: ENGRI 1XXX[b]	3	☐
Engineering Distribution 1: ENGRD 2020 (required)[b]	4	☐
Engineering Distribution 2: ENGRD 2210 (recommended)	3	☐
First Year Writing Seminar 1[c]	3	☐
First Year Writing Seminar 2	3	☐
Liberal Studies Distribution: six courses, 18-credit minimum	18	
Liberal Studies 1		☐
Liberal Studies 2		☐
Liberal Studies 3		☐
Liberal Studies 4		☐
Liberal Studies 5		☐
Liberal Studies 6		☐
Advisor-approved elective 1: two courses, 6-credit minimum	6	☐
Advisor-approved elective 2		☐

Required Major Courses (53-credit minimum)

ENGRD 2210[b]	3	☐
MAE 2030	3	☐
MAE 2250	4	☐
MAE 3230	4	☐
MAE 3240	3	☐
MAE 3260	4	☐
MAE 3270	4	☐
MAE 3280	3	☐
MAE 3780 (or ENGRD 2100 or PHYS 3360)	4	☐
MAE 4272[c,f]	3	☐
MAE 4300[f]	2	☐

M.E. Major Electives[e,a]

MAE 4xx1: Supervised Senior Design Experience[f,g]	3	☐
Mathematics Elective: MAE 3100 or ENGRD 2700 *or* CEE 3040 or ENGRD 3200[a,h]	3	☐
Technical Elective[a,i]	3	☐
Major-approved elective 1[a,e]	3	☐
Major-approved Elective 2	3	☐
Total Required Credits	128 minimum	
Technical Writing Course[c]: MAE 4272		☐

Physical Education: 1 sem ☐ 2 sem ☐ swim test ☐

Notes

a. May be taken any time in junior or senior year.

b. Introduction to Engineering (ENGRI 1XXX), ENGRD 2020, and ENGRD 2210, satisfy the Common Curriculum distribution requirement. ENGRD 2020 satisfies the major entry requirement. ENGRD 2210 satisfies the Common Curriculum distribution requirement and also fulfills the required Major requirement.

c. In addition to the first-year writing seminars, a technical writing course must be taken. MAE 4272 satisfies the technical writing requirement.

d. Introduction to Computing using MATLAB (CS 1112, CS 1114, or CS 1115) is recommended.

e. A list of approved Major-approved electives is available online at www.mae.cornell.edu

f. To be taken in fourth year.

g. Can be satisfied by independent research, project team, or by designated senior design formal course, MAE 4xx1.

h. Must be an upper-level mathematics course, which includes statistics, taken after Math 2940. A list of approved math electives is available online at www.mae.cornell.edu

i. A Technical Elective may include many courses at an appropriate level, chosen from engineering (2000+), mathematics (2940+), science (Physics 2214+), chemistry (2090+), or biological sciences. Most 2000+ technical level courses in engineering will be accepted. (Note: Engineering economic, business, management, financial, or organization courses will not be accepted, with the exception of MAE 4610.) One thousand (1000+) level courses in biological science will fulfill the technical elective requirement.

This engineering check list is formatted to conform to the general specifications of the College of Engineering. We strongly recommend you consult www.mae.cornell.edu for complete and updated Mechanical Engineering academic program information or visit 108 Upson Hall for additional information.

For announcements and additional curriculum-related information, subscribe to the MechE Undergraduate Blog: http://blogs.cornell.edu/maeugadvising/.

Major: Operations Research and Engineering (ORE)

Offered by: School of Operations Research and Information Engineering
206 Rhodes Hall, 255.4856, www.orie.cornell.edu

Program Objectives

The Operations Research and Engineering Major emphasizes the use of advanced analytical techniques in support of strategic decisions related to optimization of organizational and system performance in diverse areas, from health care to manufacturing and production, as well as marketing and financial services.

The objectives of the OR&E program are to provide students with a firm foundation in the basic principles of Operations Research, resulting in:

- proficiency with tools from optimization, probability, statistics, simulation, and engineering economic analysis, including fundamental applications of those tools in industry and the public sector in contexts involving uncertainty and scarce or expensive resources;
- facility with mathematical and computational modeling of real decision-making problems, including the use of modeling tools and computational tools, as well as analytic skills to evaluate the problems;
- facility with the design, implementation, and analysis of computational experiments in support of decision-making problems.

Engineering Distributions

ENGRD 2700: Basic Engineering Probability and Statistics (required)

ENGRD 2110[c]: Objected-Oriented Programming and Data Structures (recommended)

Required Major Courses

ORIE 3120: Industrial Data and Systems Analysis

ORIE 3150: Financial and Managerial Accounting

ORIE 3300: Optimization I

ORIE 3310: Optimization II

ORIE 3500: Engineering Probability and Statistics II

ORIE 3510: Introductory Engineering Stochastic Processes I

ORIE 4580: Simulation Modeling and Analysis

Electives

A behavioral science (organizational behavior) course

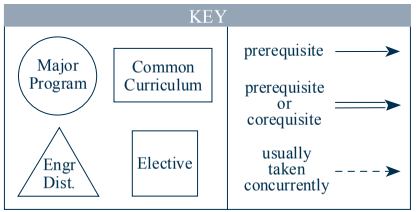
At least 9 credits of ORIE electives

At least 9 credits of Major-approved electives, with at least 3 credits from outside ORIE

At least 6 credits of Advisor-approved electives

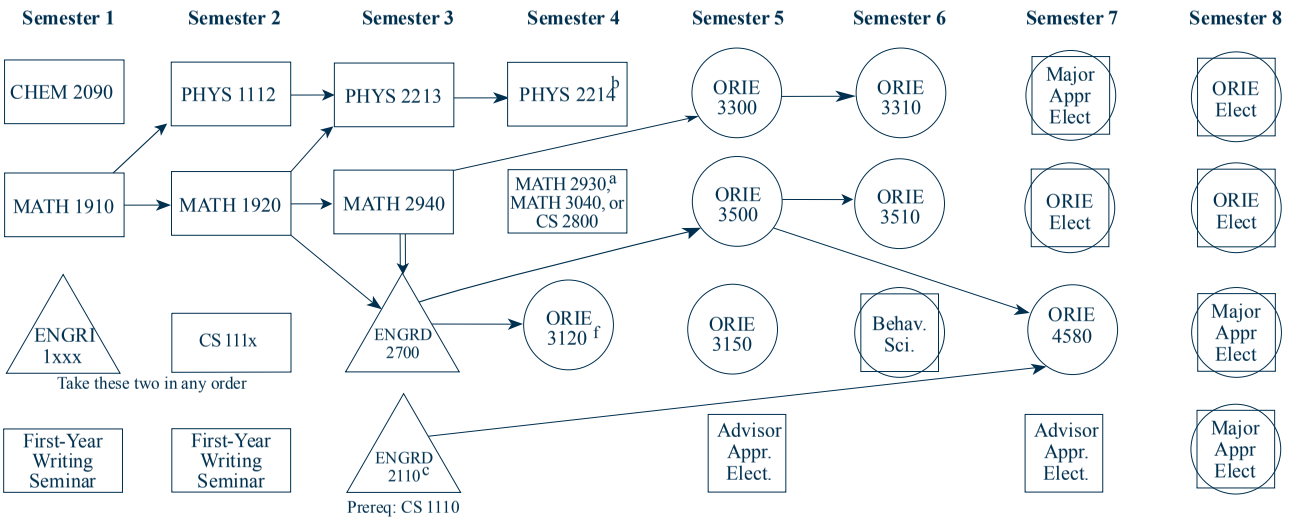
At least one of the courses taken must satisfy the technical writing requirement.

Operations Research and Engineering Major (ORE)



Requirements for Major Affiliation: Operations Research and Engineering

At least C in ENGRD 2700 and MATH 2940. GPA ≥2.2 in math, science, and engineering courses (both overall and in the term immediately before affiliation). At least C– in all completed ORIE courses. Good academic standing in the college.



Note: Liberal Studies Distribution and Physical Education requirements are not represented on this chart.

Operations Research and Engineering Major Check List

	Minimum Credit Hours	√ When Done
MATH 1910	4	☐
MATH 1920	4	☐
MATH 2930[a]	4	☐
MATH 2940	4	☐
CHEM 2090 (or 2150)	4	☐
PHYS 1112 (or 1116)	4	☐
PHYS 2213 (or 2217)	4	☐
PHYS 2214[b]	4	☐
CS 1110 (or 1112, or 1114, or 1115)	4	☐
Introduction to Engineering: ENGRI 1XXX	3	☐
Engineering Distribution 1: ENGRD 2700 (required)	3	☐
Engineering Distribution 2: ENGRD 2110[c] (recommended)	3	☐
First-Year Writing Seminar 1[d]	3	☐
First-Year Writing Seminar 2	3	☐
Liberal Studies Distribution: six courses, 18-credit minimum	18	
Liberal Studies 1		☐
Liberal Studies 2		☐
Liberal Studies 3		☐
Liberal Studies 4		☐
Liberal Studies 5		☐
Liberal Studies 6		☐
Advisor-approved elective 1: two courses, 6-credit minimum	6	☐
Advisor-approved elective 2		☐

Required Major Courses (49-credit minimum)[e]

ORIE 3120[f]	4	☐
ORIE 3150	4	☐
ORIE 3300	4	☐
ORIE 3310	4	☐
ORIE 3500	4	☐
ORIE 3510	4	☐
ORIE 4580	4	☐
Behavioral Science (organizational behavior)	3	☐
ORIE Elective	3	☐
ORIE Elective	3	☐
ORIE Elective	3	☐
Major-approved Electives—Non–ORIE[e]	3	☐
Major-approved Elective	3	☐
Major-approved Elective	3	☐
Total Required Credits	124 minimum	
Technical Writing Course[d]		☐
Physical Education: 1 sem ☐ 2 sem ☐ swim test ☐		

Notes

a. ORE affiliates are required to complete MATH 1910: Calculus for Engineers, MATH 1920: Multivariable Calculus for Engineers, and MATH 2940: Linear Algebra for Engineers (or their subject matter equivalents). MATH 2930: Differential Equations for Engineers, CS 2800: Discrete Structures, or MATH 3040: Prove It! can be used to satisfy the fourth semester mathematics requirement. Students should discuss with their advisor which of these three courses is most appropriate to their future program of study in ORE. The following should be considered:

   MATH 2930 is essential for advanced study in financial engineering. Also, MATH 2930 is a pre- or co-requisite for PHYS 2214: Physics III: Optics, Waves, and Particles, thus students who do not take MATH 2930 must plan to take CHEM 2080.

   CS 2800 provides an introduction to discrete structures and algorithms of broad applicability in the field of operations research, particularly for fundamental models in the areas of optimization, production scheduling, inventory management, and information technology; it is also a pre-requisite for certain upper-class computer science courses in the areas of information technology and algorithmic analysis.

   MATH 3040 covers fundamentals of formal proof techniques. Students considering Ph.D.-level study in Operations Research are encouraged to see the Associate Director for advice regarding the fourth math course.

b. The following courses may be substituted for PHYS 2214, if not used to meet other requirements: CHEM 2080, MATH 2930, CS 2800, MATH 3040, MATH 3110: Introduction to Analysis, or MATH 3360: Applicable Algebra. Students who prefer PHYS 2214 must take MATH 2930 as a pre- or corequisite.

c. ENGRD 2110 is required by the Major. It is recommended that this course be counted as an engineering distribution.

d. In addition to the First-year Writing Seminars, a technical writing course must be taken as an engineering distribution, liberal studies, Advisor-approved elective, or Major course.

e. The Major program includes nine (9) credits of courses outside the Major. These are satisfied by ENGRD 2110, the behavioral science course, and one Major-approved elective.

f. It is recommended that ORIE 3120 be taken in semester 4. However, if a student's schedule does not permit it, the course can be taken in semester 6 or 8.

   This engineering check list is formatted to conform to the general specifications of the College of Engineering. We strongly recommend that you visit 203 Rhodes Hall for an official Operations Research and Engineering check list or visit www.orie.cornell.edu for complete academic program information.

Major: Science of Earth Systems (SES)

Offered by: Department of Earth and Atmospheric Sciences
2124 Snee Hall, 255.5466, www.eas.cornell.edu

Program Objectives

The SES program is intrinsically interdisciplinary, involving many branches of science and engineering. It is unique in that it incorporates the fundamentals of Earth Science with the emergence of a new and more complete approach that encompasses all components of the earth system—air, life, rock, and water—to gain a new and more comprehensive understanding of the world as we know it. By analyzing the complex relations between the ocean, solid earth, atmosphere and biosphere, students can help meet society's growing demand for energy, minerals, and clean water, as well as contribute to mitigating the negative impacts related to global warming, rising sea level, natural hazards, and decreasing biodiversity.

Common Curriculum

CHEM 2090: Engineering General Chemistry
CHEM 2080: General Chemistry[a]

Engineering Distributions

ENGRD 2XXX[c]
ENGRD 2XXX

Required Major Courses

EAS/ENGRD 2250: The Earth System[c]

One biology course selected from the following:
BIOG 1140: Foundations of Biology
BIOG 1440: Introductory Biology: Comparative Physiology
BIOEE 1610: Ecology and the Environment
BIOEE 1780: Evolutionary Biology and Diversity
BIOMG 1350: Introductory Biology: Cell and Developmental Biology
BIOSM 1610: Ecology and the Marine Environment
BIOSM 1780: Evolution and Marine Diversity

One Advisor-approved course in statistics, computer science, math, or natural science[b,f]

Three courses selected from the following:[g,]

EAS 3010: Evolution of the Earth System
EAS 3030: Introduction to Biogeochemistry
EAS 3040: Interior of the Earth
EAS 3050: Climate Dynamics

Field Course (at least 3 credits):[h]

Examples include:
EAS 2500: Meteorological Observations and Instruments
EAS 4170: Field Mapping in Argentina
Courses in SEA Semester

Field courses offered at Shoals Marine Laboratory*
Field courses offered by another college or university*
Experience gained participating in field research with Cornell faculty (or REU at another institution)*

Concentration Courses

The concentration courses build depth and provide the student with a specific expertise in some facet of earth system science. Four concentrations are defined for the Major: atmospheric sciences, environmental geoscience, geological sciences, and ocean sciences. In consultation with the student's advisor and upon approval of the SES curriculum committee, other concentrations can be tailored to a student's interest. The concentration is achieved by completing four intermediate- to advanced-level courses (3000 level or above) that build on the core courses and have prerequisites in the required basic sciences and mathematics courses. These courses must be approved by the student's advisor and the director of undergraduate studies. Two of the concentration courses count as Major-required courses and two of the concentration courses count as Major-approved electives.

Electives

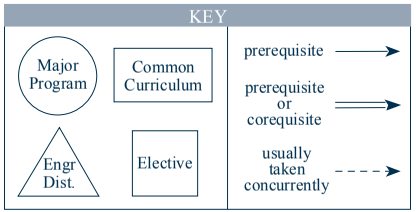
Electives must be approved by the student's faculty advisor.

One Major-approved elective at the 3000 level or above, beyond the concentration courses mentioned above.

Three outside Major Electives.[i]

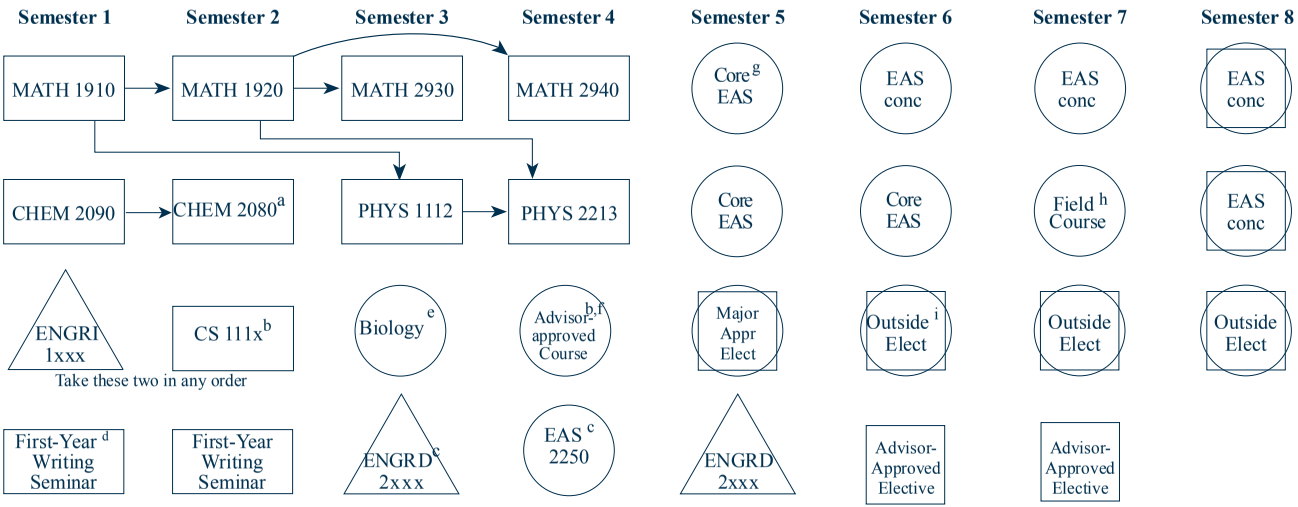
Two Advisor-approved electives.

Science of Earth Systems Major (SES)



Requirements for Major Affiliation: Science of Earth Systems

At least C- in all completed Major required courses. GPA ≥2.0 in all math, science, and engineering courses. Good academic standing in the college.



Note: Liberal Studies Distribution and Physical Education requirements are not represented on this chart.

Science of Earth Systems Major Check List

	Minimum Credit Hours	√ When Done
MATH 1910	4	☐
MATH 1920	4	☐
MATH 2930	4	☐
MATH 2940	4	☐
CHEM 2090	4	☐
CHEM 2080 (or 2150)[a]	4	☐
PHYS 1112 (or 1116)	4	☐
PHYS 2213 (or 2217)	4	☐
CS 1110 (or 1112, or 1114, or 1115)[b]	4	☐
Introduction to Engineering: ENGRI 1XXX	3	☐
Engineering Distribution 1: ENGRD 2XXX[c]	3	☐
Engineering Distribution 2: ENGRD 2XXX	3	☐
First-Year Writing Seminar 1[d]	3	☐
First-Year Writing Seminar 2	3	☐
Liberal Studies Distribution: six courses,18-credit minimum	18	
Liberal Studies 1		☐
Liberal Studies 2		☐
Liberal Studies 3		☐
Liberal Studies 4		☐
Liberal Studies 5		☐
Liberal Studies 6		☐
Advisor-approved elective 1: two courses, 6-credit minimum	6	☐
Advisor-approved elective 2		☐

Required Major Courses (48-credit minimum)

EAS/ENGRD 2250[c]	4	☐
Biology[e]	3/4	☐
Advisor-approved Course[b,f]	3/4	☐
EAS Core[g]	4	☐
EAS Core	3/4	☐
EAS Core	3	☐
Field Course[h]	3/4	☐
EAS Concentration (Major required)	3/4	☐
EAS Concentration (Major-required)	3/4	☐
EAS Concentration (Major-approved Elective)	3/4	☐
EAS Concentration (Major-approved Elective)	3/4	☐
Major-approved Elective (3XXX or higher)	3/4	☐
Outside Major Elective[i]	3/4	☐
Outside Major Elective	3/4	☐
Outside Major Elective	3/4	☐
Total Required Credits	123 minimum	
Technical Writing Course[d]		☐

Physical Education: 1 sem ☐ 2 sem ☐ swim test ☐

Notes

a. Students may substitute CHEM 1570 or PHYS 2214 for CHEM 2080. (MATH 2930 is a pre- or co-requisite for PHYS 2214.)

b. If a student elects to count CS 1110 (or CS 1112, or CS 1114, or CS 1115) as their Major-required, Advisor-approved course in statistics, computer science, math, or natural science, an additional Major-approved elective is required.

c. If a student elects to count EAS/ENGRD 2250 as an ENGRD, an additional Major-approved elective is required.

d. In addition to the First-year Writing Seminars, a technical writing Course must be taken as an engineering distribution, liberal studies, Advisor-approved elective, or Major course.

e. One of the following courses must be selected: BIOG 1140, BIOG 1440, BIOEE 1610, BIOEE 1780, BIOMG 1350, BIOSM 1610, or BIOSM 1780.

f. An Advisor-approved course in statistics, computer science, mathematics, or natural science (including, but not limited to, a course in astronomy, a second course in biology, or an additional course in physics or chemistry).

g. Three courses selected from the following core course options:
EAS 3010: Evolution of the Earth System
EAS 3030: Introduction to Biogeochemistry
EAS 3040: Interior of the Earth
EAS 3050: Climate Dynamics

h. Field course options marked by an asterisk (*) require pre-approval by the faculty advisor and the SES Curriculum Committee. These courses/internships/REUs should require observations to be taken in the field and interpreted by the student. Field courses should generally require 40+ hours of active observation and data collection in the field. Students will be required to give a presentation on their field work when they return. Students using a non-credit research option for the field course requirement are required to complete an additional 3+ credits of EAS Concentration courses.

i. The Major program includes nine (9) credits of courses outside the Major.

Minors

In an effort to encourage multi-disciplinary and cross-disciplinary study at Cornell, students enrolled in an undergraduate college may pursue minors offered by units in any college or division. A unit that offers a minor may place restrictions on who can pursue that minor (usually because of limited resources), and a Major may place restrictions on the minors that its students can pursue (usually because the Major and minor areas overlap closely in content).

Completion of a minor will be audited by the unit that offers it. The minor will be recorded on a student's official transcript by their home college after receiving verification by the unit offering the minor, usually after graduation. Students should inquire with individual departments for application procedures and requirements.

Students undertaking a minor are normally expected to complete the requirements during the time of their continuous undergraduate enrollment at Cornell. Since courses for minor requirements may also satisfy other degree requirements (e.g. distribution courses, Advisor-approved electives), the minor may sometimes be completed within the traditional eight semesters. However, more than eight semesters may be needed.

The rest of this section describes the Engineering minors—the minors offered by departments and schools of the College of Engineering.

Courses required for a minor do not necessarily satisfy a Major requirement. For example, some minor courses may not be used as Major-approved electives. Check with your faculty advisor or Major Coordinator.

To complete an Engineering minor, an engineering student must

- be enrolled in a Major that approves participation of its affiliates in the desired Engineering minor.
- successfully complete all the requirements for a Bachelor of Science degree in engineering.
- satisfactorily complete six courses (18-credit minimum) as stipulated in the Engineering minor offered by an engineering department/school.

Each course used to satisfy an Engineering minor must be taken for a letter grade, if that option exists.

The College of Engineering currently offers minors in the following areas (offering units are indicated in parentheses):

Aerospace Engineering (MAE)

Applied Mathematics (MAE)

Biological Engineering (BEE)

Biomedical Engineering (BME)

Civil Infrastructure (CEE)

Computer Science (CS)

Dyson Business Minor for Engineers, offered by the College of Agriculture and Life Sciences

Electrical and Computer Engineering (ECE)

Engineering Entrepreneurship (BEE/CHEME/CE/ECE/MSE/MAE/ORE)

Engineering Management (CEE)

Engineering Statistics (ORIE)

Environmental Engineering (BEE/CEE)

Game Design (CS)

Industrial Systems and Information Science Technology (ORIE)

Information Science (IS)

Materials Science and Engineering (MSE)

Mechanical Engineering (MAE)

Operations Research and Management Science (ORIE)

Science of Earth Systems (EAS)

Sustainable Energy Systems (CBE/BEE/EAS/MAE)

Additional information on specific Engineering minors can be found in the Major office of the department/school offering the minor, in *Courses of Study,* in Engineering Advising, and on the pages that follow.

Minor: Aerospace Engineering

Offered by: Sibley School of Mechanical and Aerospace Engineering
Contact: MAE Undergraduate Coordinator, 108 Upson Hall, phone 255.3573, np18@cornell.edu.

Eligibility

All undergraduates. Pre-approval is required. Students intending to earn this minor should seek advice and pre-approval from the Associate Director for Undergraduate Affairs in MAE before taking courses toward the minor.

Educational Objectives

The Aerospace Engineering minor develops the engineering-analysis and design skills necessary for creating and understanding aerospace vehicles and their subsystems. The minor includes diverse topics relevant to applications both in the Earth's atmosphere (e.g. aerodynamics) and in space (e.g. spacecraft thermal systems or orbital mechanics). Students in this minor will take at least four core aerospace courses, along with up to two supporting courses in engineering fundamentals or courses with applicability to aeronautics and spacecraft.

Requirements

1. Six courses from the lists below, each worth at least 3 credits. No substitutions accepted from other departments at Cornell or elsewhere.

2. Rules for ME Majors:
   (a) Select at least four courses from group A, of which you must choose MAE 3050 or MAE 4060 (or both).
   (b) Select at most two courses from group B. No courses from group C may be used.
   (c) Two courses must be selected from the Aerospace Engineering subject field from Mechanical Engineering Major approved electives in Mechanical Engineering (for a complete listing, consult www.mae.cornell.edu). These two courses may not be used towards fulfilling the B.S., Mechanical Engineering degree requirements.
3. Rules for other Majors:
   (a) Select at least four courses from group A, of which you must choose MAE 3050 or MAE 4060 (or both).
   (b) Select a total of at most two courses from group B and group C.
   (c) You may not use any courses to satisfy requirements of both the Mechanical Engineering minor and the Aerospace Engineering minor.

Group A: Core Aerospace Engineering

MAE 3050: Introduction to Aeronautics

MAE 4060: Introduction to Spaceflight Mechanics

MAE/ECE 4150: GPS: Theory and Design

MAE 4160/4161/5160: Spacecraft Technology and Systems Architecture

MAE 4291[a]: Supervised Senior Design Experience (with Aerospace focus), *or*
MAE 4900[a]: Individual and Group Projects in Mechanical Engineering (with Aerospace focus)

MAE 4230/5230: Intermediate Fluid Dynamics

MAE 4510/5510: Propulsion and Power

MAE 5070: Dynamics of Flight Vehicles

Group B: Courses Applicable to Aerospace Engineering

MAE 4020/4021/5020: Wind Power

MAE 4130/4131/5130: Mechanics of Composites

MAE 4140/4141: Mechanics of Lightweight Vehicles

MAE 4180/5180: Autonomous Mobile Robots

MAE 4700/4701/5700: Finite Element Analysis for Mechanical and Aerospace Design, *or*
CEE 4720: Introduction to the Finite Element Method

MAE 4730/5730: Intermediate Dynamics and Vibrations

MAE 4780/5780/CHEME 4720/ECE 4720: Feedback Control Systems

MAE 5430: Combustion Processes

MAE 6510: Advanced Heat Transfer

Group C: Fundamentals

ENGRD 2020: Statics and Mechanics of Solids

MAE 2030: Dynamics

ENGRD/MAE 2210: Thermodynamics

MAE 2120: Mechanical Properties and Selection of Engineering Materials

MAE 3230: Introductory Fluid Mechanics

MAE 3240: Heat Transfer

MAE 3250: Analysis of Mechanical and Aerospace Structures

MAE 3260: System Dynamics

MAE 3780: Mechatronics
or
ECE/ENGRD 2100: Introduction to Circuits for Electrical and Computer Engineers or
PHYS 3360: Electronic Circuits

Academic Standards

At least C– in each course. In S/U only courses, S is acceptable

Note

a. MAE 4291 and 4900 require a form signed by the project advisor, stating that the project focuses on Aerospace and is suitable as a core aerospace course for the minor. MAE 4291 or 4900 must be worth 3 credits or more. Students may count at most one MAE 4291 or one MAE 4900 toward the minor (i.e. they may not count both MAE 4291 and MAE 4900 toward the minor).

Minor: Applied Mathematics

Offered jointly by: Sibley School of Mechanical and Aerospace Engineering and the Department of Mathematics

Students intending to earn a minor in Applied Mathematics should seek advice and pre-approval of their minor academic program from Professor Richard Rand, rhr2@cornell.edu.

Eligibility

Engineering undergraduates affiliated with all Engineering Majors are eligible to participate in the Applied Mathematics minor.

Educational Objectives

This minor is aimed at providing a focus for students who are interested in applied mathematics.

Requirements

Students must take MATH 2930, MATH 2940, and at least six (6) courses beyond MATH 2940, to be chosen as follows:

(a) At most, one course may be chosen from each of groups 1–4.

(b) At least three courses must be chosen from groups 5 and 6.

(c) At most one 2000-level course may be chosen.

(d) At most one course may be chosen that is offered by the student's Major department.

Group 1. Analysis

AEP 4210: Mathematical Physics I

MAE 3100: Introduction to Applied Mathematics

MATH 3230: Introduction to Differential Equations

MATH 4200: Differential Equations and Dynamical Systems

Group 2. Computational Methods

CS 4210: Numerical Analysis and Differential Equations

ENGRD 3200: Engineering Computation

ENGRD 3220: Introduction to Scientific Computation

ORIE 3300: Optimization I

Group 3. Probability and Statistics

CEE 3040: Uncertainty Analysis in Engineering

ECE 3100: Introduction to Probability and Inference for Random Signals and Systems

ENGRD 2700: Basic Engineering Probability and Statistics

MATH 4710: Basic Probability

ORIE 3500: Engineering Probability and Statistics II

Group 4. Applications

AEP 3330: Mechanics of Particles and Solid Bodies

CEE 3310: Fluid Mechanics

CEE 3710: Structural Modeling and Behavior

CHEME 3230: Fluid Mechanics

CS 2800: Discrete Structures

CS 2850: Networks

ECE 3200: Networks and Systems

ECE 4250: Digital Signal and Image Processing

MAE 3230: Introductory Fluid Mechanics

MATH 3610: Mathematical Modeling

MSE 3030: Thermodynamics of Condensed Systems

Group 5. Advanced Courses

Only one of the following two may be chosen:

AEP 4220: Mathematical Physics II

CS 4220: Numerical Analysis: Linear and Nonlinear Problems

MATH 4220: Applied Complex Analysis

Only one of the following two may be chosen:

ECE 4110: Random Signals in Communications and Signal Processing

ORIE 3510: Introductory Engineering Stochastic Processes I

You may also choose from:

CS 4220: Numerical Analysis: Linear and Nonlinear Problems

CS 4810: Introduction to Theory of Computing

CS 4820: Introduction to Analysis of Algorithms

ORIE 3310: Optimization II

ORIE 4330: Discrete Models

ORIE 4350: Introduction to Game Theory

ORIE 4520: Introductory Engineering Stochastic Processes II

ORIE 5600: Financial Engineering with Stochastic Calculus I

ORIE 5610: Financial Engineering with Stochastic Calculus II

MAE 4730/5730: Intermediate Dynamics and Vibrations

MAE 5790/MATH 4210: Nonlinear Dynamics and Chaos

MAE 6700: Advanced Dynamics

MAE 6810: Methods of Applied Mathematics I

MAE 6820: Methods of Applied Mathematics II

MAE 6840: Asymptotics and Perturbation Methods

Group 6. Mathematics Courses

Any 3000+ level course offered by the Mathematics Department in algebra, analysis, probability/statistics, geometry, or logic, with the following exceptions:

(i) MATH 3230 or MATH 4200, if any course from group 1 is chosen.

(ii) MATH 4710, if any course from group 3 is chosen.

(iii) MATH 4220, if AEP 4220 is chosen from group 5.

(iv) Only one of the following may be chosen:

MATH 3320: Introduction to Number Theory

MATH 3360: Applicable Algebra

Academic Standards

At least C in each course in the minor.

Minor: Biological Engineering

Offered by: Department of Biological and Environmental Engineering
Contact: BEE Major Coordinator, 207 Riley-Robb Hall.

Students may participate in either the Biological Engineering minor or the Biomedical Engineeering minor, but not both.

Note: Students should meet with the BEE Major Coordinator when they decide to pursue the minor. At that time they will receive a BEE faculty advisor, who will guide them in completing the minor program.

Educational Objectives

Biological engineering is the application of engineering to living systems. Examples of engineering efforts in this field include the development of new biosensor technologies, study and control of biologically based matter-transformation systems, and development of engineered devices to study and regulate fundamental biological processes. This minor is an opportunity for students to further their understanding of living systems and to increase their knowledge of the basic transport processes that occur within these systems. Courses in the minor provide opportunities to analyze, design, and manipulate living systems at the molecular, cellular, and system levels.

Requirements

At least six (6) courses (minimum of 18 credits), with at least three courses and 9 credits taught in BEE, chosen as follows:

I. Biology Foundation (at least one but no more than two courses)

BIOMG 3300 or 3310-3320: Principles of Biochemistry

BIOMG 3330 or 3350: Principles of Biochemistry: Proteins, Metabolism, and Molecular Biology

BIOMG 3850: Developmental Biology

BIOMG 4320: Survey of Cell Biology

BIOMI 4160: Bacterial Physiology

BIOMI 4850: Bacterial Genetics

II. Biological Engineering Core (at least one but no more than two courses)

BEE/ENGRD 2600: Principles of Biological Engineering

BEE 3310: Bio-Fluid Mechanics

BEE 3400: Design and Analysis of Biomaterials

BEE 3500: Heat and Mass Transfer in Biological Engineering

BEE/BME 3600: Molecular and Cellular Bioengineering

III. Biological Engineering Focus Area Electives (Minimum of three courses)

Choose any three courses from the focus area lists at beadvised.bee.cornell.edu. Courses appearing in more than one focus area do not double count. BEE 3400 and BEE 3600 may be taken as either a focus area elective or a core course.

Academic Standards

At least C– in each course in the minor and a GPA ≥2.0 in all courses in the minor.

Minor: Biomedical Engineering

Offered by: Department of Biomedical Engineering
Contact: Major Coordinator, 108 Weill Hall, minor_bme@cornell.edu

Eligibility

All undergraduates are eligible regardless of undergraduate major. Students may participate in either the Biological Engineering minor or the Biomedical Engineering minor, but not both.

Educational Objectives

Biomedical engineering is the application of engineering principles and methods to a wide array of problems associated with human health. The discipline includes the design of biocompatible materials, prostheses, surgical implants, artificial organs, controlled drug-delivery systems, and wound-closure devices. Diagnosing diseases and determining their biological origins depend on increasingly sophisticated instrumentation and the use of mathematical models. This minor allows students to gain exposure to the breadth and depth of biomedical engineering offerings at Cornell, to prepare for advanced studies in biomedical engineering, and to obtain recognition for their interest and capability in this rapidly growing area.

Requirements

- At least six (6) courses (minimum of 18 credits) from the five categories listed below.
- Two courses need to be in Category 1 (Introductory Biology) and/or Category 2 (Advanced Biology) with no more than one listing from Category 1.
- Four courses must come from Category 3 (Molecular and Cellular Biomedical Engineering); Category 4 (Biomedical Engineering Analysis of Physiological Systems); and Category 5 (Biomedical Engineering Applications), with courses from at least two of these categories represented.
- At least four of the six courses must not be specifically required Major degree courses or cross-listings. A course chosen from a list of major electives is acceptable.

Students are asked to join the bmeundergrads-L@cornell.edu listserve to receive biomedical information updates. Consult the web site www.bme.cornell.edu/academics/undergraduate/bem.cfm for instructions.

Category 1. Introductory Biology (maximum of 4 credits; 3-8 credits count as one course toward this category.)

A score of 5 on (CEEB) Advanced Placement Biology

ENGRI 1310: Introduction to Biomedical Engineering

BIOMG 1350: Principles of Cell and Developmental Biology

BIOG 1440: Introductory Biology: Comparative Physiology, *or*
BIOG 1445: Introduction to Comparative Anatomy and Physiology, Individualized Instruction

CHEME 2880: Biomolecular Engineering: Fundamentals and Applications

Category 2. Advanced Biology

BIOAP 3160/BIOMS 3160: Cellular Physiology

BIOMG 3300 or 3310-3320: Principles of Biochemistry

BIOMG 3330 or 3350: Principles of Biochemistry, Proteins, Metabolism, and Molecular Biology

BIOMG 2810: Genetics and Genomics

BIOMI 2900: General Microbiology Lectures

BIONB 2220: Neurobiology and Behavior II: Introduction to Neurobiology

NS 3410: Human Anatomy and Physiology

Category 3. Molecular and Cellular Biomedical Engineering

BEE/BME 3600: Molecular and Cellular Bioengineering

BME 3010/CHEME 4010[a]: Molecular Principles of Biomedical Engineering

BME 3020/CHEME 4020[a]: Cellular Principles of Biomedical Engineering

Category 4. Biomedical Engineering Analysis of Physiological Systems

BIONB/BIOAP/BIOMS 4140: Principles of Pharmacology

BIONB/BME/COGST/PSYCH 3300: Introduction to Computational Neuroscience

BIONB/BME 4910: Principles of Neurophysiology

BME 4010/MAE 4660[a]: Biomedical Engineering Analysis of Metabolic and Structural Systems

BME 4020[a]: Electrical and Chemical Physiology

MAE/BME 4640: Orthopaedic Tissue Mechanics

MSE 5130: Mechanobiology of Materials and Cells

Category 5. Biomedical Engineering Applications

AEP 4700/BIONB 4700/BME 5700: Biophysical Methods

BEE 4500: Bioinstrumentation

BEE/MAE 4530: Computer-Aided Engineering: Applications to Biomedical Processes

BME 5400: Biomedical Computation

BME 5810/MAE 5680: Soft Tissue Biomechanics

BME 6310: Engineering Principles for Drug Delivery

CHEME/BME 4810: Biomedical Reaction Engineering

CS/BIOMG/ENGRD 3510: Numerical Methods in Computational Molecular Biology

ECE/BME 4980: Special Topic: Introduction to Systems and Synthetic Biology

ECE 5780: Computer Analysis of Biomed Images (next offered in SP14)

MSE 4610: Biomedical Materials and their Applications

MSE/BME 5620: Biomineralization: The Formation and Properties of Inorganic Biomaterials

FSAD 4390/BME 5390: Biomedical Materials and Devices for Human Body Repair

Academic Standards

At least C– in each course in the minor. GPA ≥2.0 for all courses in the minor. All courses must be taken for a letter grade.

Note

a. Students interested in professional practice as biomedical engineers should consider the M.Eng. degree in BME. The recommended sequence for admission is as follows, two courses from category I and category II, BME 3010, 3020, 4010, and 4020. The program requires that students have knowledge of molecular and cellular biomedical engineering and of biomedical engineering analysis of physiological systems.

Minor: Civil Infrastructure

Offered by: School of Civil and Environmental Engineering
Contact: CEE Undergraduate Major Coordinator, 221 Hollister Hall, 607.255.3412, www.cee.cornell.edu

Eligibility

All undergraduates except Civil Engineering Majors.

Educational Objectives

The Civil Infrastructure minor is intended to introduce engineering undergraduates to the engineering methodologies of mechanics, materials, analysis, design, and construction and to show how these are brought to bear in solving problems in the development, maintenance, and operation of the built environment that is vital for any modern society.

Requirements

At least six (6) courses (minimum of 18 credits), chosen as follows:

Required Course

ENGRD 2020: Mechanics of Solids

Additional Courses: Choose any five (groupings are for information only)[a]

Geotechnical Engineering

CEE 3410: Introduction to Geotechnical Engineering

CEE 4400: Foundation Engineering

CEE 4410: Retaining Structures and Slopes

CEE 4450: Soil Dynamics and Geotechnical Earthquake Engineering

Structural Engineering

CEE 3710: Structural Modeling and Behavior

CEE 3720: Intermediate Solid Mechanics

CEE 4710: Fundamentals of Structural Mechanics

CEE 4730: Design of Concrete Structures

CEE 4740: Introduction to the Behavior of Metal Structures

CEE 4780: Structural Dynamics and Earthquake Engineering

Other Related Courses

CEE 5950: Construction Planning and Operations

Academic Standards

At least C in each course in the minor.

Note

a. Other CEE courses approved by petition in advance.

Minor: Computer Science

Offered by: Department of Computer Science
Contact: Nicole Roy, 110E Gates Hall, 255.0982, nsr1@cornell.edu

Eligibility

All undergraduates except Computer Science Majors and Information Science, Systems, and Technology Majors.

Educational Objectives

This minor is for students who anticipate that computer science will have a prominent role to play in their academic and professional career. It is designed for students in all Majors to supplement their primary studies. Computer science is applicable to almost any Major and career choice —from Communications, Psychology, and Law, to Architecture, Music, and Engineering. The theoretical foundations of information and computation provide students with the appropriate skills for academic and professional careers. Completion of a CS minor, with a well-selected set of classes, can serve as a good preparation for further study in the CS Masters of Engineering (M.Eng) program. The CS minor is designed for students in all undergraduate schools and colleges.

Requirements

At least six (6) courses (minimum of 18 credits) chosen as follows:

Required Courses

CS/ENGRD 2110: Object-Oriented Programming and Data Structures, *or*
CS/ENGRD 2112: Object-Oriented Programming and Data Structures—Honors

CS 3410: Computer System Organization and Programming, *or*
CS 3420/ECE 3140: Embedded Systems

Additional Courses

Four (4) CS courses numbered 3000 or higher, with the following exceptions:
CS 4090, CS 4999, and seminars are excluded.
CS 2800 is allowed.

Academic Standards

A letter grade of C or better is required for each course in the minor.

Note

Cross-listed courses cannot be applied to the minor unless taken under the rubric CS (e.g. CS 4300 counts, but INFO 4300 does not), with the sole exceptions of ECE 3140 and CS courses also listed as ENGRD. All qualifying courses must be taken at Cornell for a letter grade. No substitutions allowed.

Minor: Dyson Business Minor for Engineers

Offered by: College of Agriculture and Life Sciences
Contact: Nancy Bell, Dyson Undergraduate Minor Coordinator, 375 Warren Hall or email: minors.dyson@cornell.edu

Eligibility

All Engineering undergraduates are eligible to declare their intent to minor in the Dyson Business Minor for Engineers (DBME) beginning in the freshman year and no later than the end of their sixth semester. The Declaration of Intent to Minor may be filed up to two semesters prior to completing the prerequisite microeconomics requirement, and offers students the benefit of preferential scheduling in AEM courses which are part of the minor.

Prerequisites

Completion of (or enrollment in) ECON 1110: Introductory Microeconomics, or equivalent course with a passing grade (including AP or appropriate credit that appears on the student's official transcript). S/U grade option is permitted for the prerequisite class.

Requirements

All courses for the minor must be completed with a grade of C or better. At least 7 credits must be taken in the Dyson School (AEM). Students must complete one course in each of the following categories:

Category 1. Introduction to Basic Business Concepts: (3 credits)

AEM 1200: Introduction to Business Management

AEM 2400: Marketing

Non-Dyson Options: ENGRI 1270, NCC 5580, ORIE 4152, HADM 2410, NCC 5530

Category 2: Introduction to Accounting Principles*: (3 credits)

AEM 2210: Financial Accounting

Non-Dyson Options: ORIE 3150, NCC 5500, HADM 2230

Category 3: Understanding Finance: (3 credits)

AEM 2241: Finance (formerly AEM 2240)

Non-Dyson Options: HADM 2250, NCC 5560

Category 4: Integrating Marketing, Finance, Human Resources and Operations: (1.5 credits)

Minor: Game Design

AEM 4660: Market Dynamics, Computer Simulation and Modeling

Category 5: Business/Management Course to Support Career Goals*: (3 credits)

At least one 3XXX- or 4XXX-level business-related course in the Dyson School related to business career goals. Courses must be chosen from an approved list (no substitutions permitted), which can be found at: http://minors.dyson.cornell.edu

Notes

*Special considerations for students majoring in ORIE:

(1) ORIE students must take ORIE 3150 plus any of the following courses to fulfill the accounting requirement for the Dyson Minor: AEM 3360, 3500, 4170, 4210, 4230, 4260, 4280, and 4290. All but AEM 3360 can also

satisfy a Major-approved Elective from category B towards their ORIE requirements. ORIE 4150, 4154, 4600, and 4630 would also satisfy this depth requirement.

(2) ORIE majors may not use AEM 3100 or AEM 4120 to fulfill the category 5 requirement.

For complete details (including the online Declaration of Intent), please visit: http://minors.dyson.cornell.edu.

Minor: Electrical and Computer Engineering

Offered by: School of Electrical and Computer Engineering
Contact: ECE Undergraduate Major Coordinator, 222 Phillips Hall

Eligibility

All undergraduates except Electrical and Computer Engineering Majors.

Educational Objectives

The School of Electrical and Computer Engineering offers a minor to students who wish to complement their Major with a background in electrical and computer engineering. The minor offers the opportunity to study analog and digital circuits, signals and systems, electromagnetic fields, and to specialize at higher levels in one of several different areas such as circuit design and electronic devices, communications and signal processing, computer engineering and networks, or electromagnetic and space engineering.

Requirements

At least six (6) courses (minimum of 18 credits), chosen as follows:

Two (2) of the following:

ENGRD/ECE 2100: Introduction to Circuits for Electrical and Computer Engineers

ECE 2200/ENGRD 2220: Signals and Information

ENGRD/ECE 2300: Introduction to Digital Logic Design

Two (2) of the following

ECE 3030: Electromagnetic Fields and Waves

ENGRD/ECE 3100: Introduction to Probability and Random Signals

ECE 3140/CS 3420: Embedded Systems

ECE 3150: Introduction to Microelectronics

ECE 3250: Mathematics of Signal and Systems Analysis

One (1) other technical ECE lecture course at the 3000 level or above (3-credit minimum)

One (1) other technical ECE lecture course at the 4000 level or above (3-credit minimum)

Academic Standards

At least C– for every course in the minor and a GPA ≥2.3 for all courses in the minor.

Minor: Engineering Entrepreneurship

Offered collaboratively by: Biological Engineering, Chemical Engineering, Civil Engineering, Electrical and Computer Engineering, Materials Science in Engineering, Mechanical and Aerospace Engineering, Operations Research in Engineering
Contact: MSE Undergraduate Major Coordinator, 210 Bard Hall, 607.255.9159

Eligibility

All Engineering undergraduates. Students pursuing the Independent Major should obtain approval for the proposed minor courses to avoid significant overlap with approved primary and secondary area programs.

Educational Objectives

This minor focuses on giving engineering students the skills necessary to identify and evaluate opportunities and begin new business ventures. The coursework leads to an understanding and ability in intellectual property, competition, technology assessment, product development, finance, and accounting—the tools necessary to start a high technology business.

Requirements

At least six (6) courses (minimum of 18 credits), chosen as follows:

Required Course (1)

I. ENGRG 2270: Introduction to Entrepreneurship for Engineers

Additional Courses

II. Engineering Ethics (one from this list)
or
BEE 4400: Engineering Ethics

ENGRG 3600: Ethical Issues in Engineering Practice

INFO 4301: Ethics in New Media, Technology, and Communication

III. History of Capitalism and Technology (one from this list)

HIST 2500: Technology in Society

HIST 2920: Inventing an Information Society

HIST 3022: Capitalism and American Democracy: 1880-2010

HIST 3411: Engineering in History

IV. Accounting and Finance (one from this list)

HADM 4211: Entrepreneurial Finance

ORIE 3150: Financial and Managerial Accounting

V. Ideation and Design Thinking (one from this list)

CHEME 4630: Practice of Chemical Engineering Product Design

MAE 4340: Innovative Product Design via Digital Manufacturing

MSE 5070: Interdisciplinary Design Concepts

SYSEN 5740: Design Thinking for Complex Systems

VI. Capstone Entrepreneurship (one from this list)

BEE 4890: Entrepreneurial Management for Engineers

ORIE 4152: Entrepreneurship for Engineers

Academic Standards
At least C- in each course in the minor.

Notes
1. Experiential Learning: Students are encouraged to consider completing a summer internship or co-op placement with an entrepreneurial or venture capital company. Please contact the Cornell Engineering Career Center office, the Red Bear Angel Group, and the Entrepreneurship@Cornell office for assistance in finding such positions.

2. Other courses may be approved by petition in advance.

Minor: Engineering Management
Offered by: School of Civil and Environmental Engineering
Contact: CE Undergraduate Major Coordinator, 221 Hollister Hall, 607.255.3412, www.cee.cornell.edu

Eligibility
All undergraduates. (CE Majors may not use courses to fulfill the minor requirement and simultaneously as a Major-approved elective or as a Design course.) ORE Majors have restrictions and requirements as noted below. Students pursuing the Independent Major should obtain approval from CEE for the proposed minor courses, as they may relate to approved primary and secondary area programs.

Educational Objectives
This minor focuses on giving engineering students a basic understanding of engineering economics, accounting, statistics, project-management methods, and analysis tools necessary to manage technical operations and projects effectively. The minor provides an important set of collateral skills for students in any engineering discipline.

Requirements
At least six (6) courses (minimum of 18 credits), chosen as follows:

Required Courses (3)

CEE 3230: Engineering Economics and Management
or
ORIE 4150: Economic Analysis of Engineering Systems

ORIE 3150[a]: Financial and Managerial Accounting

CEE 3040[b]: Uncertainty Analysis in Engineering
or
ENGRD 2700: Basic Engineering Probability and Statistics
or
ECE 3100: Introduction to Probability and Inference for Random Signals and Systems

Additional Courses (choose any three)[c]

CEE 5930[d]: Engineering Management Methods:

CEE 5950: Construction Planning and Operations

CEE 5970: Risk Analysis and Management

CEE 5980: Introduction to Decision Analysis

ENGRG 3600: Ethical Issues in Engineering Practice

NBA 5070: Entrepreneurship for Scientists and Engineers
or
MAE 4610/ENGRG 4610/ORIE 4152: Entrepreneurship for Engineers
or
BEE 4890: Entrepreneurial Management for Engineers

Academic Standards
At least C in each course in the minor.

Notes

a. ORE Majors must substitute NCC 5560: Managerial Finance or NBA 5000: Intermediate Accounting for ORIE 3150.
b. MAE 3100: Introduction to Applied Mathematics I cannot be substituted for CEE 3040.
c. Other courses approved by petition in advance.
d. This course is not accepted for ORE Majors.

Minor: Engineering Statistics

Offered by: Department of Statistical Science and School of Operations Research and Information Engineering
Contact: ORE Undergraduate Major Consultant, 203 Rhodes Hall, 255.5088.

Eligibility
All undergraduates except Operations Research and Engineering Majors. A student may not receive credit for more than one minor offered by ORIE.

Educational Objectives
This minor requires the student to develop expertise in engineering statistics. The goal of the program is to provide a firm understanding of statistical principles and engineering applications and the ability to apply this knowledge in real-world situations.

Requirements
At least six (6) courses (minimum of 18 credits), chosen as follows:

Required Courses

ENGRD 2700: Basic Engineering Probability and Statistics

ORIE 3500: Engineering Probability and Statistics II
or
ECE 3100: Introduction to Probability and Random Signals

Four courses (11 credits minimum) taken from the following list[a]

ORIE 3510: Introductory Engineering Stochastic Processes I
or
ECE 4110: Random Signals in Communications and Signal Processing

ORIE 4580: Simulation Modeling and Analysis

ORIE 4710: Applied Linear Statistical Models

ORIE 4711: Experimental Design

ORIE 4712: Regression

ORIE 5550: Applied Time-Series Analysis

ORIE 5770: Quality Control

MATH 4720: Statistics or BTRY 4090: Theory of Statistics

BTRY 6020: Statistical Methods II

BTRY 6030: Statistical Methods III
or
ILRST 4110: Statistical Analysis of Qualitative Data
or
ILRST 3100: Statistical Sampling

ILRST 4100: Techniques of Multivariate Analysis

Academic Standards

At least C– in each course in the minor and a GPA ≥2.0 in all courses in the minor.

Note

a. Other course options approved by petition in advance. The student should be aware that some of these courses require others as prerequisites. All these courses are cross-listed under the Dept. of Statistical Science.

Minor: Environmental Engineering

Offered by: Department of Biological and Environmental Engineering and School of Civil and Environmental Engineering
Contact: BEE Undergraduate Major Coordinator, 207 Riley-Robb Hall, or CEE Undergraduate Major Coordinator, 221 Hollister Hall

Eligibility

All undergraduates except Environmental Engineering Majors. Civil Engineering Majors may not use courses to fulfill simultaneously the minor requirements and a Major-approved elective or design course for the Environmental Engineering Major.

Educational Objectives

A fundamental challenge for the engineering profession is development of a sustainable society and environmentally responsible industry and agriculture reflecting an integration of economic and environmental objectives, and implementation of renewable energy resources. We are called upon to be trustees and managers of our nation's resources, the air in our cities, and water in our aquifers, streams, estuaries, and coastal areas. This minor encourages engineering students to learn about the scientific, engineering, and economic foundations of environmental engineering so that they are better able to address environmental management and sustainability issues.

Requirements

At least six (6) courses (minimum of 18 credits), chosen as follows:

Students must select courses from the following group listings, with at least one (1) course from each group.

Group A. Environmental Engineering Processes

BEE/ENGRD 2510: Engineering Processes for Environmental Sustainability

BEE 4010: Renewable Energy Systems

BEE 4200/6200: Surface Chemistry of Particles in Natural and Engineered Processes

BEE 4760: Solid Waste Engineering

BEE/EAS 4800: Our Changing Atmosphere: Global Change and Atmospheric Chemistry

CEE 3510: Environmental Quality Engineering

CEE 4510: Microbiology for Environmental Engineering

CEE 4530: Laboratory Research in Environmental Engineering

CEE 4540: Sustainable Municipal Drinking Water Treatment

CEE 4550: AguaClara: Sustainable Water Supply Project

CEE 6530: Water Chemistry for Environmental Engineering

CEE 6560: Physical/Chemical Process

CEE 6570: Biological Processes

ENGRI 1130: Sustainable Design for Appledore Island (may count only if taken before the third year)

Group B. Environmental Systems

BEE 4750: Environmental Systems Analysis

BEE 4870: Sustainable Bioenergy Systems

BEE 4880: Applied Modeling and Simulation for Renewable Energy Systems

CEE 5970: Risk Analysis and Management

CHEME 6660: Analysis of Sustainable Energy Systems

Group C. Hydraulics, Hydrology, and Environmental Fluid Mechanics

BEE 3710: Physical Hydrology for Ecosystems

BEE 4270: Water Measurement and Analysis Methods

BEE/EAS 4710: Introduction to Groundwater

BEE 4730: Watershed Engineering

BEE 4740: Water and Landscape Engineering Applications

CEE 3310: Fluid Mechanics (CHEME 3230: Fluid Mechanics or MAE 3230: Introductory Fluid Mechanics may be substituted for CEE 3310)

CEE 4320/6320: Hydrology

CEE 4370: Experimental Methods in Fluid Dynamics

CEE 6310: Computational Simulation of Flow and Transport in the Environment

CEE 6550: Transport, Mixing, and Transformation in the Environment

Academic Standards

At least C– in each course in the minor and a GPA ≥2.0 in all courses in the minor.

Minor: Game Design

Offered by: Department of Computer Science
Contact: Nicole Roy, 110E Gates Hall, 255.0982, nsr1@cornell.edu

Eligibility

All undergraduates. CS Majors cannot apply CS/ENGRD 2210/2112, or courses taken under the CS rubric (with the sole exception of CS 4152 or CS 4154), to the Additional Courses requirement of the Game Design Minor.

Educational Objectives

This minor is for students who anticipate that game design will play a prominent role in their academic and professional career.

To apply for a Game Design minor:

- Complete course work required for the minor (see below).
- Obtain the form "Application to Certify Completion of an Engineering minor" from Engineering Advising in 167 Olin Hall.
- Obtain an official transcript from the University Registrar's Office in B7 Day Hall.
- Complete the form and attach the copy of your transcript on which each course used for the minor is highlighted or underlined.
- Submit the form and the transcript to the Computer Science undergraduate office, 110E Gates Hall.

Requirements

At least six (6) courses (18 credit minimum) chosen as follows:

Required Courses:

CS/INFO 3152: Introduction to Computer Game Architecture/Design

CS/INFO 4152: Advanced Topics in Computer Game Architecture, *or*
CS 4154: Analytics-driven Game Design

Additional Courses: Choose four of the following courses:

ART 2701: Introduction to Digital Media

ART 3704: Interactive Digital Media

COMM 4220: Psychology of Entertainment Media

CS/ENGRD 2110 or CS/ENGRD 2112: Object-Oriented Programming and Data Structures

CS/INFO 3300: Data-Driven Web Applications

CS/INFO 4152: (if not used as a Required Course): Advanced Topics in Computer Game Architecture/Design

CS 4154: (if not use as a Required Course): Analytics-driven Game Design

CS 4620/ARCH 3704: Introduction to Computer Graphics

CS 4700: Foundations of Artificial Intelligence

CS 5625: Interactive Computer Graphics

CS 5643: Physically Based Animation for Computer Graphics

ECE 4760: Digital Systems Design Using Microcontrollers

INFO/COMM 2450: Communication and Technology

INFO/COMM 3450: Human–Computer Interaction Design

INFO 3460: Crowds, Communities, and Technology

INFO/ARTH 3650: Technology in Collaboration

INFO/COMM 4400: Advanced Human–Computer Interaction Design

MUSIC 2421: Performing with Computers

MUSIC 3421: Scoring the Moving Image

MUSIC 3431/PMA 3680: Sound Design and Digital Audio

PMA 2730: Introduction to Dramatic Writing

PMA 3444: Animation Workshop: Experimental and Traditional Methods

PMA 3445: Animaiton History and Practice

PMA 3614: Creative Character Design

PSYCH 3420/COGST 3420/VISST 3342: Human Perception: Applications to Computer Graphics, Art, and Visual Display

Academic Standards

A letter grade of C or better is required for each course in the minor.

Minor: Industrial Systems and Information Technology

Offered by: School of Operations Research and Information Engineering
Contact: ORE Undergraduate Major Consultant, 203 Rhodes Hall, 255.5088.

Eligibility

All undergraduates except those majoring in Information Science; Information Science, Systems, and Technology; or Operations Research and Engineering. A student may not receive credit for more than one minor offered by ORIE.

Educational Objectives

The aim of this minor is to provide an in-depth education in issues central to the design and analysis of operational systems and the tools from information technology that have become an integral part of the manufacturing, finance, service, and public-health industries. Students will become familiar with the problems, perspectives, and methods found in these fields and be prepared to work with professionals in designing and managing them. That is, rather than providing a comprehensive view of the range of methodological foundations of operations research, this minor is designed to give the student a focused education in application areas closely associated with these techniques.

Requirements

At least six (6) courses (minimum of 18 credits), chosen as follows:

Required courses:

ENGRD 2700: Basic Engineering Probability and Statistics

ORIE 3120: Industrial Data and Systems Analysis

ORIE 4800: Information Technology

The remaining courses/credit hours from the following:

ORIE 3150: Financial and Managerial Accounting

ORIE 3300: Optimization I

ORIE 4150: Economic Analysis of Engineering Systems

ORIE 4580: Simulation Modeling and Analysis

ORIE 4810: Delivering OR Solutions with Information Technology

ORIE 4850: Applications of Operations Research and Game Theory to Information Technology

ORIE 5100: Design of Manufacturing Systems

ORIE 5120: Production Planning and Scheduling Theory and Practice

ORIE 5770: Quality Control

Academic Standards

At least C– in each course in the minor and a GPA ≥2.0 in all courses in the minor.

Minor: Information Science

Offered by: Department of Information Science
Contact: Amy Sindone, 110H Gates Hall, 255.9837, ISminor@infosci.cornell.edu

Eligibility

All students except those majoring in Information Science, Systems, and Technology are eligible. Students interested in pursuing the Information Science minor must initiate the process by sending an email message with their name, college, year of study (e.g. second-semester second-year student), expected graduation date, and (intended) Major to minor@infosci.cornell.edu.

Educational Objectives

The program has three main areas: Information Systems, Human-Centered Systems, and Social Systems. The minor has been designed to ensure that students have substantial grounding in all three areas in addition to having a working knowledge of basic probability and statistics necessary for analyzing data occurring in the real world.

Requirements

At least six (6) courses (minimum of 18 credits) chosen as follows:

Statistics: one course, either CEE 3040 or ENGRD 2700

Information Systems: two courses

Human-Centered Systems: one course

Social Systems: one course

Elective: one additional course from either Human-Centered Systems or Social Systems

Academic Standards

At least C in each course in the minor. All courses for the minor must be taken at Cornell.

For a complete listing of course options and restrictions, visit www.infosci.cornell.edu/academics/undergraduate/undergraduate-minor-information-science.

Minor: Materials Science and Engineering

Offered by: Department of Materials Science and Engineering
Contact: MSE Undergraduate Program Coordinator, 210 Bard Hall, 255.9159

Eligibility

All undergraduates except those majoring in Materials Science and Engineering.

Educational Objectives

Materials form the core basis of many engineering disciplines including mechanical, civil, chemical, and electrical engineering. This minor provides engineers in related Majors with the fundamental understanding of mechanisms that determine the performance, properties, and processing of modern materials.

Requirements

At least six (6) courses (≥18 credits), chosen as follows:

Required

MSE 2610: Mechanical Properties of Materials: From Nanodevices to Superstructures
or
MSE 2620: Electronic Materials for the Information Age

Two of the following:

MSE 2060: Atomic and Molecular Structure of Matter

MSE 3010: Materials Chemistry

MSE 3030: Thermodynamics of Condensed Systems

MSE 3040: Kinetics, Diffusion, and Phase Transformation

MSE 3050: Electronic, Magnetic, and Dielectric Properties of Materials

MSE 4020: Mechanical Properties of Materials, Processing, and Design

Three electives chosen from the following:

- MSE 2610, MSE 2620, and any MSE course at the 3000 level or above
- Selected courses in materials properties and processing (at the 3000 level or above) from AEP, CHEME, CEE, ECE, MAE, PHYS, and CHEM, as approved by the MSE undergraduate coordinator. (Courses listed as "Materials Applications Electives" on the MSE web site meet this requirement.)

Academic Standards

At least C in each course in the minor.

Minor: Mechanical Engineering

Offered by: Sibley School of Mechanical and Aerospace Engineering
Contact: MAE Undergraduate Coordinator: 108 Upson Hall, 255.3573, np18@cornell.edu

Eligibility

All undergraduates except those majoring in Mechanical Engineering.

Students intending to earn this minor should seek advice and pre-approval from the Associate Director for Undergraduate Affairs in Mechanical Engineering. Contact np18@cornell.edu, 108 Upson Hall before taking courses toward the minor.

Educational Objectives

The primary educational objective of this minor is to give students from outside MAE the necessary skills and tools to interact technically with mechanical engineers on various multidisciplinary fronts. This minor has the appearance of being very broad since it encompasses nearly all of the MAE upper-division courses. However, the prerequisites of the upper-division courses may dictate that a student concentrate in a subarea of mechanical engineering. A recommended strategy for designing a minor is to select a few upper-level courses of interest and work backward from them to determine what courses will be needed as prerequisites or prerequisites of prerequisites. (Note: Instructors may waive certain prerequisites in some circumstances.) The prerequisite structure dictates that most curricula will focus either on fluids/thermal systems or mechanical systems/design courses.

Requirements

At least six (6) courses (≥18 credits) from among the following: MAE courses at the 2000+ level; ENGRD 2020: Mechanics of Solids; and MAE 2030: Dynamics.

Rules for Selecting Courses

The selection of courses must satisfy the following three requirements.

- At least two courses must be numbered above 3000.
- At least one course must be either (i) numbered above 5000 or (ii) numbered above 3260 and have as its prerequisite ENGRD 2020, MAE 2030, or an MAE course.
- Each course must be worth at least 3 credits.

All courses used to satisfy the ME minor must be MAE courses, ENGRD 2020, or MAE 2030. No substitutions will be accepted from other departments at Cornell or elsewhere. Transfer credit cannot be used to satisfy the ME minor. MAE 4980: Teaching Experience in Mechanical Engineering, may not be used to satisfy the ME minor. Applications for the ME minor may be obtained in 108 Upson Hall. Credits from MAE 4900 or 4291 may be used for at most one course in the minor.

Academic Standards
At least C– in each course in the minor

Minor: Operations Research and Management Science

Offered by: School of Operations Research and Information Engineering
Contact: ORE Undergraduate Major Consultant, 203 Rhodes Hall, 255.5088

Eligibility
All undergraduates except those majoring in ORE or ISST. A student may receive credit for at most one minor offered by ORIE.

Educational Objectives
Operations Research and Management Science (OR&MS) aims to support decision-making through modeling and analysis of complex systems. This understanding is used to predict system behavior and improve system performance. This minor gives the student the opportunity to obtain a wide exposure to the core methodological tools for OR&MS, including mathematical programming, stochastic and statistical models, and simulation. The intent of this minor is to provide a broad knowledge of the fundamentals, rather than training the student in a particular application domain. With this preparation, students can adjust their advanced courses and pursue either methodological or application-oriented areas most relevant to their educational goals.

Requirements
At least six (6) courses (≥18 credits), chosen as follows:

Choose three courses from the following list:

ENGRD 2700: Basic Engineering Probability and Statistics

ORIE 3300: Optimization I

ORIE 3310: Optimization II

ORIE 3500: Engineering Probability and Statistics II

ORIE 3510: Introduction Engineering Stochastic Processes I

ORIE 4580: Simulation Modeling and Analysis

Any ORIE courses at the 3000 level or higher (including those above)

Academic Standards
At least C– in each course in the minor and a GPA ≥2.0 in all courses in the minor.

Minor: Science of Earth Systems

Offered by: Department of Earth and Atmospheric Sciences
Contact: SES Undergraduate Major Coordinator, 2124 Snee Hall, 255.5466, www.eas.cornell.edu

Eligibility
All undergraduates except those majoring in Science of Earth Systems.

Educational Objectives
Some of the major problems facing mankind in this century involve earth science, and the engineering workforce will be challenged to solve these problems. This minor will prepare engineering students to understand the natural operating systems of Earth and the tools and techniques used by earth scientists to understand and monitor these solid and fluid systems.

Requirements
At least 18 credits, chosen as follows:

1. Required introductory course:

EAS 2250: The Earth System

2. At least two courses selected from the following options:

EAS 3010: Evolution of the Earth System

EAS 3030: Introduction to Biogeochemistry

EAS 3040: Interior of the Earth

EAS 3050: Climate Dynamics

3. Additional EAS courses at the 3000 level or higher.

These may include, but are not limited to, additional courses from the above list, undergraduate research courses, and outdoor field courses.

Academic Standards

At least C– in each course in the minor. GPA ≥2.0 for all courses in the minor.

Minor: Sustainable Energy Systems

Offered collaboratively by: Department of Biological and Environmental Engineering, Robert Frederick Smith School of Chemical and Biomolecular Engineering, Department of Earth and Atmospheric Sciences, and The Sibley School of Mechanical and Aerospace Engineering. Administered by the Robert Frederick Smith School of Chemical and Biomolecular Engineering.
Contacts: Curricular topics: Jeff Tester, Croll Professor of Sustainable Energy Systems and Director, Cornell Energy Institute; Administrative or registrar topics: Carol Casler, undergraduate programs office of the Robert Frederick Smith School of Chemical and Biomolecular Engineering, 607-255-1489

Eligibility
All undergraduates at Cornell.

Educational Objectives
Providing affordable energy to meet the demands of both developed and developing nations without further damaging the natural environment and the Earth's climate system

is a grand challenge for the 21st century. Our quality of life and the stability of nations ultimately depend on having accessible energy resources and an equitable and sustainable energy supply and distribution system. Achievement of thes goals requires the participation, ingenuity, and hard work of people with a range of specialized backgrounds, working collaboratively. The minor is intended to emphasize the importance of viewing the challenge of meeting the world's energy needs as a *system* of interacting themes. The requirements of the minor are designed to provide breadth across a range of energy resource types and conversion, transmission, and storage technologies along with coverage of the environmental, economic, political, and social consequences of various options.

Requirements

- Six courses and a minimum of 18 credits; at least 3 credits in each category
- At least two courses (together totaling no less than 3 credits) in category 2: Energy Sources and Technologies for a Transition to Sustainability
- At most two courses may be specific requirements in the student's Major
- At least one course from each of four breadth categories

Four Breadth Categories

(1) Energy Systems Analysis

(2) Energy Sources and Technologies for a Transition to Sustainability

(3) Natural Systems Impacted by Energy Production and Use

(4) Social Impact: Policy, Economics, Business, History, Ethics, and Risk Analysis

Courses satisfying each of the breadth categories:

(1) Energy Systems Analysis

BEE 4010: Renewable Energy Systems

CHEME 6650: Energy Engineering

CHEME 6660: Analysis of Sustainable Energy Systems

MAE 5010: Future Energy Systems

(2) Energy Sources and Technologies for a Transition to Sustainability

(a) Fossil and Nuclear Energy

CHEME 5204/5207: Turbomachinery Applications/Hydrocarbon Resources (series of two 1-2 credit hour courses)

CHEME 6650: Energy Engineering

CHEME 6666: Unconventional Natural Gas Development from Shale Formations Module

CHEME 6670: Fossil Fuels Module

CHEME 6671: Nuclear Energy Module

EAS 4010: Fundamentals of Earth and Minerals Resources

EAS 4340: Exploration Geophysics

MAE 4580/AEP/CHEME/ECE/NSE/TAM 4130: Introduction to Nuclear Science and Engineering

MAE 4590/AEP/ECE/NSE 4840: Introduction to Controlled Fusion: Principles and Technology

(b) Renewable Energy

AEP 5500: Applied Solid State: Physics of Renewable Energy

BEE 4880: Applied Modeling and Simulation for Renewable Energy Systems

BEE 6940: Graduate Special Topics in Biological and Environmental Engineering; Topic: Applied Optimization in Engineering, Energy, and the Environment (offered alternate years)

CEE 6200: Water-Resources System Engineering

CHEME 6661: Bioenergy and Biofuels Module

CHEME 6662: Solar Energy Module

CHEME 6663: Geothermal Energy Module

CHEME 6664/CEE 6364: Hydrokinetic and Aerodynamic Energy Module

MAE 4020: Wind Power

MSE 5150: Structures and Materials for Sustainable Energy Systems

(c) Energy Conversion, Distribution, and Storage

CEE 4650: Transportation, Energy, and Environmental Systems for Sustainable Development

CHEME 6650: Energy Engineering

CHEME 6667/CEE 6667: Transportation Energy Systems Module

CHEME 6672: Electric Power Systems Module

CHEME 6674: Energy Metals Module: Source, Use and Challenges

ECE 4510: Electric Power Systems I

ECE 4520: Electric Power Systems II

ECE 5870/CHEME 5870: Energy Seminar I, *or*
ECE 5880/CHEME 5880: Energy Seminar II (one credit only)

MAE 5430: Combustion Processes

MSE 4330: Materials for Energy Production, Storage and Conversion

SYSTEN 5100/CEE 5240/ECE 5120/MAE 5910/ORIE 5140: Model Based Systems Engineering

SYSTEN 5200/CEE 5252/ECE 5130/MAE 5920/ORIE 5142: Systems Analysis Behavior and Optimization

(3) Natural Systems Impacted by Energy Production and Use

BEE 3710: Physical Hydrology for Ecosystems

BEE/EAS 4800: Our Changing Atmosphere: Global Geophysics and Atmospheric Chemistry

BEE 6740: Ecohydrology

BIOEE/EAS 3500: Dynamics of Marine Ecosystems

BIOEE/NTRES 4560: Stream Ecology

CEE 4320: Hydrology

CHEME 6610: Air Pollution Control

EAS/NTRES 3030: Introduction to Biogeochemistry

EAS 3050: Climate Dynamics

EAS 3530: Physical Oceanography

EAS 4400: Seminar: Climate Science, Impacts, and Mitigation

EAS 4570: Atmospheric Air Pollution

EAS 4850: Climate Information and Management (energy-related project required)

EAS 3880: Global Geophysics

MAE/EAS 6480: Air Quality and Atmospheric Chemistry

EAS/CHEME 6677: Seismic Risk in Energy Development

EAS/CHEME 6668: Earth Systems Behavior and Resources Module

EAS/CHEME 6669: Earth Energy Science and Engineering Module

NTRES 4201: Forest Ecology Laboratory and NTRES 4200: Forest Ecology

NTRES 4221: Wetland Ecology Laboratory and NTRES 4220: Wetland Ecology Lecture

(4) Policy/Economics/Business/History/Ethics/Risk Analysis

AEM 4510/ECON 4090: Environmental Economics

BEE 5400: Engineering Ethics and Professional Practice

BSOC/STS 2061/PHIL 2460: Ethics and the Environment

BSOC/STS/HIST 3181: Living in an Uncertain World: Science, Technology and Risk

CEE/TOX 5970: Risk Analysis and Management

CHEME 6640: Energy Economics

CHEME/CEE 6667: Transportation Energy Systems Module

CHEME 6673: Tools for Analyzing Energy and Society Module

CHEME 6675: Energy Life Cycle Assessment Module

DSOC 3240/STS 3241/SOC 3240: Environment, Society, and Land

ENGRG/ECE/HIST 2500/STS 2501: Technology in Society

ENGRG/ECE 3600/STS 3601: Ethical Issues

NTRES 3320: Introduction to Ethics and the Environment

ORIE 4150: Economic Analysis of Engineering Systems

Consult www.sustainablefuture.cornell.edu/education/minors.php, the web site of the Atkinson Center for a Sustainable Future, for updates regarding requirements and acceptable courses.

Academic Standards

At least C- in each course, or, for S/U Only courses, S.

Special Programs

Concurrent Degree Option

The Concurrent Degree Program is intended for superior students. Students can earn both a Bachelor of Science and either a Bachelor of Arts or a Bachelor of Fine Arts degree in about five years (ten semesters). In order to apply to the Concurrent Degree Program, Engineering students must be affiliated and have a 3.3 GPA. Engineering students begin the Concurrent Degree Program in their second or third year. For more information about this option, students should contact the Office of Internal Transfer and Concurrent Degrees.

Exceptional students may be able to arrange (by petition) an accelerated program and finish in less than 10 semesters. Such a program may not rely on summer work or credits earned at community colleges. Students in the program may decide to complete only one degree, but it may be difficult to complete the requirements for either degree in four years because of the way their curriculum has been structured.

Double Majors

The double Major makes it possible to study two allied engineering disciplines. A double Major generally requires nine semesters.

To embark on a double Major, a student must complete the entry requirements for both Majors and have a cumulative GPA $\geq$3.0 after the first four semesters. Affiliation with the first Major proceeds as usual. Before the end of the third year, the student presents an application for Double Major to enter the second Major. The application must be approved by the faculty in both Majors. The second Major may set its own requirements, and admission is not guaranteed. Note: Due to curricular overlap, students majoring in Information Science, Systems, and Technology (ISST), may not pursue a double Major with either Computer Science (CS) or Operations Research and Engineering (ORE). Due to curricular overlap, students majoring in Environmental Engineering wishing to pursue a double major in Civil or Biological Engineering must contact the undergraduate Director of Environmental Engineering for eligibility. Obtain application forms from Engineering Advising and submit completed forms to the Engineering Registrar, 158 Olin Hall.

Double-Major students have a faculty advisor in each Major. Both Majors maintain records, approve course changes, and eventually certify to the registrar that all requirements for the B.S. degree have been met.

The standards for academic performance of both Majors must be met, although the consequences for failing to do so for one or the other will differ. For example, deficient perfomance in the primary Major may result in a required leave of absence or withdrawal from the Major (resulting perhaps in withdrawal from the college), but deficient performance in the secondary Major simply terminates the double Major. For more information, contact the individual Major offices.

The Independent Major (IM)

The IM is an opportunity for students whose educational objectives cannot be met by any of the traditional Majors. It allows students to create specially tailored, interdisciplinary courses of study. The student develops the program in consultation with faculty advisors; it is approved by the Independent Major Committee, which is responsible for overseeing the student's progress.

The IM includes a primary engineering area of ≥32 credits and an educationally related secondary area of ≥16 credits. The primary area may be any subject area offered by the engineering schools or departments; the secondary area is a logically connected subject area comprised of Cornell courses. The program must constitute an engineering education in scope and substance, and all requirements of the Common Curriculum must be met.

Students should apply by the end of their sophomore year and must meet good academic standing requirements for unaffiliated students. They should seek assistance in developing a coherent program from professors in the proposed primary and secondary subject areas. If approved, the program becomes a curricular contract to which the student must adhere. For more information, contact Engineering Advising, 167 Olin Hall.

Note: Because no single standardized curriculum exists, the IM is not accredited. IM students who intend to seek legal licensing as Professional Engineers should be aware that this non-accredited degree program will require additional education, work, and/or experience to be eligible to take the Fundamentals of Engineering examination.

International Engineering Programs

An international perspective, sensitivity to other cultures, and the ability to speak a second language are increasingly important to today's engineer. The College of Engineering encourages students to study or work abroad during their undergraduate years to prepare for participation in the global marketplace.

Because most engineering curricula are highly structured with many sequential courses, students who wish to pursue this option must decide early and plan carefully. Advisors and faculty in the college can suggest a variety of ways for students to study abroad and still meet graduation requirements. Students interested in studying or working abroad should begin gathering information early in the first year. Programs may fit some students' curriculum plans better than others', depending on a variety of factors, including Advanced Placement credit, completed prerequisites, and Major affiliation requirements. Students must complete courses abroad that apply to degree requirements and must seek pre-approval for these courses in order to gain College approval to study abroad. Study abroad plans that delay graduation will not be approved. Students should refer to the college and university policies related to study abroad on the Cornell Abroad web site (https://www.cuabroad.cornell.edu).

On campus, there are several sources of specific information on study abroad:

- Cornell Abroad office, 300 Caldwell Hall
- Engineering Advising, 167 Olin Hall, www.engineering.cornell.edu/studyabroad
- the associate director of undergraduate studies in the student's Major

Engineering Communications Program (ECP)

The ECP provides instruction in technical writing, oral presentation, and the use of graphics in both. ECP courses are like writing seminars elsewhere at Cornell. Students' work receives abundant written comments and conferences are frequent.

Members of the ECP are available to help engineering faculty members develop materials for their own writing and oral-presentation assignments.

For more information, call 255.7199, visit the Director's office at 465 Hollister Hall, or go to www.engineering.cornell.edu/ECP/.

Engineering Cooperative Education Program (Co-op)

The Co-op program provides an opportunity to gain 28 weeks of career-related practical work experience and still graduate in four years. By supplementing course work with carefully monitored paid positions, co-op students can explore their interests and acquire a better understanding of engineering as a profession.

To be eligible, students must be enrolled in the College of Engineering an equivalent of five semesters before starting their first work term. Exceptions may be made for transfer students and others pursuing an accelerated curriculum. Students majoring in computer science or biological engineering, but not registered in the College of Engineering, are also eligible. In most cases, a GPA > 2.7 is required.

Applicants interview with employers in February of the sophomore year and, upon accepting an offer, usually complete their fifth-semester course work on campus during the summer after sophomore year. They begin the first co-op work term the following fall, complete the sixth semester on campus, and return to their co-op employer the following summer for their second work term. Students spend the senior year on campus, graduating on schedule with their class. Students with flexible course curriculums may prefer to complete one 28-week spring/summer or summer/fall co-op work term during the junior year.

Obtain more information at www.engineering.cornell.edu/coop or at the Cornell Engineering Career Center office, 201 Carpenter Hall, 255.3512.

Engineering Leadership Program

Cornell engineering majors enter a world that calls on them to solve our most urgent problems and improve our quality of life. The Engineering Leadership Program prepares students to answer this call. We provide a path for the next generation of engineers to identify problems and commit to solving them; to present a vision of a better future that compels others to follow; to align actions with values; and to coordinate the efforts of many in order to have a meaningful and intentional impact.

Students can get involved with the Leadership Program in various ways requiring

differing levels of commitment. We teach collaboratively in existing courses, including many freshman advising seminars and upper-level group-based technical classes. We sponsor guest speakers on a variety of topics. Those seeking a deeper level of engagement can apply in October to the one-year Engineering Leadership Certification Program.

Because we believe great leadership development engages the heart and the mind, we emphasize empirically-derived knowledge combined with personal inquiry and growth. Our mission is to grow powerful leaders who take on our world's biggest challenges with knowledge, skill, insight, and courage.

For additional information, call the Director at 255-9074, email coe_leader@cornell.edu, stop by our offices in 152 and 156 Olin Hall, or visit www.engineering.cornell.edu/resources/leadership_program/.

Engineering Student Project Teams

The Engineering Student Project Teams provide opportunities for students across all engineering and related disciplines to participate in hands-on design, development, and construction of novel methods and projects. Students use their technical knowledge, creativity, entrepreneurism, and leadership skills to engage in international competitions and service projects. Our teams bring together people whose collective experiences and perspectives provide the foundation for solving complex problems. The success of our teams stems from their diversity and the sound engineering principles they bring to bear on the problems they encounter. For detailed information, please visit www.engineering.cornell.edu/teams.

Undergraduate Research

Engineering Learning Initiatives (ELI) is committed to facilitating connections and providing funding support for undergraduate students who are motivated to pursue research opportunities during their time at Cornell. Research enhances the undergraduate experience by allowing students to apply the skills and knowledge learned in the classroom to real engineering problems and to contribute to the advancement of knowledge in their fields. Research gives students the opportunity to interact closely with faculty mentors and, in many instances, to develop valuable industry connections. Engineering students and faculty members may apply for funding awards to support undergraduate research projects for the fall, spring, and summer terms. Funds may be used to provide a student stipend or to cover project expenses. Student researchers submit a report and present their work in a public poster session at the end of the term. For more information on tips for locating a faculty mentor, suggested research topics, application information, selection criteria, and funding sources, visit Engineering Learning Initiatives on the web at www.engineering.cornell.edu/learning/.

Course Registration

Registration

Being registered with the university and the College of Engineering and completing course enrollment are two different things. To be registered with both the university and the College of Engineering, new students must have

- obtained their ID card,
- paid their bursar bill,
- submitted all required health forms to Gannett Health Services, and
- attended a first-year or transfer briefing.

Students who have not followed this procedure must register with both the University Registrar (B7 Day Hall) and the Engineering Registrar (158 Olin Hall) and then meet with an advisor in Engineering Advising (167 Olin Hall) to receive and discuss course registration materials.

Continuing students are automatically registered after the due date of the tuition fee payment, provided the above criteria have been met and no academic or judicial holds prevent registration. *The Student Center,* an online student service, will provide students with information regarding their registration status at the beginning of each semester.

The Course Add/Drop Form

Early in the semester, students can use their Student Center online account to make most course-enrollment changes. Some "permission only" courses may require students to submit an add/drop form, obtainable at the Engineering Registrar's office, 158 Olin Hall.

The add/drop form requires the following information:

- Student Identification Number, semester, and year of study, and full name.
- The four to five-digit course identification number (CID), the department/course name, and the number of credit hours for the course a student wishes to change. (This information can be found via the Student Center or in the Course and Time Roster, which is also available online.)
- Approval from the department offering the course. Because each department keeps a running tally of the numbers of students enrolled in each lecture, section, or laboratory, students must receive departmental approval before making formal changes to their schedule. (The location of departmental offices can be found in the campus directory or *Courses of Study*.)
- The student's signature and the date.

Submit the completed add/drop form in person to the Engineering Registrar's office, 158 Olin Hall. There, a staff member will process the changes and return one copy of the form. It is important that students keep this record of the change and check their schedules on *Student Center* periodically during the semester for accuracy.

Adding a Course

Students may add courses to their schedule at any time before the end of the 15th calendar day of the term, using Cornell's electronic add/drop system or an add/drop form mentioned in the previous section for "permission only" courses.

To add a course after the deadline, a petition (available in the Engineering Registrar's office, 158 Olin Hall) is required in addition to the add/drop form. Like the add/drop form, the petition must be endorsed by the student's advisor. Submit the completed petition and add/drop form to the Engineering Registrar's office, 158 Olin Hall.

Dropping a Course

Students may drop a course(s) any time before the end of the 57th calendar day of the term, using Cornell's electronic add/drop system or an add/drop form mentioned earlier for "permission only" courses.

Beginning after the 57th day, students may continue to drop courses using a petition and an add/drop form (available in the Engineering Registrar's Office, 158 Olin Hall). The petition must be signed by the student's academic advisor. Submit the completed petition and add/drop form to the Engineering Registrar's Office, 158 Olin Hall.

Courses dropped after the 57th day are marked with a grade of "W" (for withdrawal) on the official transcript. "W" is a matter of record: its removal cannot be petitioned.

The deadline for withdrawing from a class with a petition will be published early in the term in "Dates and Deadlines".

Physical Education classes are conducted under the auspices of the Physical Education Department. The drop deadline for Physical Education courses supersedes the University drop deadline. The deadline is published and also announced in the class itself. It is the student's responsibility to withdraw from a Physical Education class prior to the drop deadline to avoid any course fees, late fees, or penalties. All drops and withdrawals after the Physical Education drop deadline must be done in person in the Physical Education Office in 305 Helen Newman Hall. For more information, see http://pe.cornell.edu/policies.

Changing a Grade Option

During the first 57 calendar days of the semester, change a grade option (on courses where a choice between letter or S/U grade is offered) using the online add/drop system, or with an add/drop form for "permission only" courses. If an add/drop form is used, permission of the faculty advisor and course instructor or departmental representative must be obtained. Submit the completed add/drop form to the Engineering Registrar's office, 158 Olin Hall, by the end of the 57th day of the term.

Important: After the 57th day of the term, the grading option may not be changed, nor will students be permitted to add a course in which they were previously enrolled (in the current semester) under a different grade option. This deadline is strictly enforced. (For more information on the policies for the S/U Grading Option, see "Grades and Credits" in this handbook.)

Changing Credit Hours

Certain upper-level courses in the Engineering curriculum are offered with "variable" credit hours. Students decide the number of credits they wish to register for when they enroll, in consultation with the instructor and their faculty advisor. (For example, a course listed as "variable to 5 credits" can be taken for 1, 2, 3, 4, or 5 credits.)

During the first 15 calendar days of the semester, change credit hours (on courses that offer variable credit) using the online add/drop system, or with an add/drop form for "permission only" courses. If an add/drop form is used, permission of the faculty advisor and course instructor or departmental representative must be obtained. Submit the completed add/drop form to the Engineering Registrar's office, 158 Olin Hall, by the 15th day of the term.

After the first 15 days of the semester, variable credit hours may not be changed except by petition (see previous section on "adding a course" for instructions).

Course Pre-Enrollment through CoursEnroll

Each semester, there is a period (usually near the middle of the semester) during which students electronically request courses they plan to take during the next semester, using the online service, *Student Center.* It provides the most accurate, up-to-date listings of course offerings for the coming semester and is available at http://studentcenter.cornell.edu.

Each semester, the University Registrar's office assigns each class (first- through fourth-year) a designated time period during which class enrollment will be accessible through *Student Center.* This access schedule is published in written form by the University Registrar's office and in the weekly email newsletter, *The Sundial.*

To request courses through *Student Center:*

- Determine your pre-enrollment access period by reading *The Sundial,* by contacting the Engineering Registrar's office, 158 Olin Hall, or by checking your *Student Center* account.
- Check the online Course and Time Roster or view classes via *Student Center.*
- Decide which courses you want to take the next semester, keeping in mind the requirements for the Common Curriculum and your intended Major program.
- Meet with your faculty advisor prior to the pre-enrollment period to discuss the proposed course schedule and make changes as necessary.
- Use *Student Center* to enter your course choices.

This completes the pre-enrollment process.

Maximum Number of Credits per Semester

The college permits (but does not encourage) students to take up to 23 credits per semester—excluding physical education courses, supplementary courses, and other courses that do not count toward the degree. Those who wish to take more than 23 credits must complete the appropriate petition. Add/drop forms that result in a schedule of more than 23

credits will not be processed without a petition endorsed by the student's faculty advisor and approved by a representative of CASPAC.

Research for Credit vs. Pay

Students who conduct research in the college may have the opportunity to receive academic credit or pay for their efforts. Students should consult with their faculty advisor and research mentor to decide which option is available to them and best for their educational goals and for the project. If receiving academic credit, students should contact the department's Undergraduate Coordinator for additional information. Those who receive credit for research may not receive pay for the same work effort on the project.

ROTC Courses

ROTC courses may be used to satisfy engineering degree requirements as follows:

1. Up to 6 credits of ROTC courses numbered ≥ 3000 may be used as Advisor-approved electives;
2. Selected ROTC courses may be used to satisfy the liberal studies requirement. (For details, see: www.engineering.cornell.edu/apps/liberalstudies/index.cfm);
3. ROTC courses that are co-listed by another department (e.g. NAVS 3050: Principles of Navigation). Some Majors further restrict the use of particular courses co-listed with Military Science. Check with the Major department office to find out whether such courses will count toward graduation.

Grades and Credit

Grades

The grading system used at the university is shown below.

Letter	Grade Point Value	Description
A+ A A–	4.3 4.0 3.7	Excellent to Very Good: comprehensive knowledge and understanding of subject matter; marked perception and/or originality
B+ B B–	3.3 3.0 2.7	Good: moderately broad knowledge and understanding of subject matter; noticeable perception and/or originality
C+ C C–	2.3 2.0 1.7	Satisfactory: reasonable knowledge and understanding of subject matter; some perception and/or originality.
D+ D D–	1.3 1.0 0.7	Marginal: minimum knowledge and understanding of subject matter; limited perception and/or originality.
F	0.0	Failing: unacceptably low knowledge and understanding of subject matter; severely limited perception and/or originality.

S	–	"Satisfactory" equivalent to C– or above
U	–	"Unsatisfactory" equivalent to below C–

Symbols Used in Lieu of Grades

INC	The student has substantial passing-level equity in the course but is unable to complete it because of circumstances beyond their control.
R (Registered)	This grade substitute is given after the first semester of a full-year course that does not require a grade until the end.
W (Withdrew)	The student withdrew from the course (with college permission) after the 57th day of the term (or beyond three-fifths of the duration of shorter courses).

S/U Grading Option

In some courses students have the option of receiving a grade of satisfactory or unsatisfactory (S or U) instead of a letter grade. Students may pre-register for such a course under the S/U option or change the grading option before the 57th calendar day of the semester. Changing a grade option is accomplished by completing the "Changes to Grade Option or Credit Hours" section of an add/drop form; this requires permission of the student's faculty advisor and the course instructor or departmental representative. A grade of S is equivalent to a letter grade of A+ through C–; U is equivalent to a grade of D+ or less.)

Important: **After the 57th day of the term, the grading option may not be changed, nor will students be permitted to add a course in which they were previously enrolled (in the current semester) under a different grade option.**

Engineering students may choose to receive an S/U grade option under the following conditions:

- The course is offered with an S/U option.
- The student has completed at least one full semester of study at Cornell. First-year students may not take any courses on an S/U basis during their first semester except for courses that are graded "S/U Only".
- The S/U course can only be used as either a liberal-studies distribution or an Advisor-approved elective in the Engineering common curriculum.
- No more than 15 S/U optional credits will count toward a student's degree requirements. However, a student may take more than one S/U course in any one semester. If a course is offered "S/U Only", it will not count toward the 15-credit limit.

Note: S/U courses do not count toward eligibility for the Dean's List and may weaken chances for acceptance into graduate school.

Incomplete Grades

There are many legitimate reasons for delaying completion of a course beyond the time allotted. An extended illness or serious injury, for example, might make it impossible to finish by the end of the semester. In such situations, it is desirable to receive a temporary grade of incomplete and finish the course work at a later time.

To receive an incomplete, students must:

- Have an extenuating reason that prevents them from completing the course in the time allotted; and
- Have passing equity in the course at the time of the request. (This is generally defined as completion of at least half the course work at a passing level.)

Incomplete grades are granted at the discretion of the course instructor. If a student thinks an incomplete is appropriate, he/she should discuss it with the instructor, making sure to arrange specific conditions under which the missing work is to be completed and set a deadline for submission. Generally, deadlines are one-year, but instructors may require shorter deadlines, and may, at their own discretion, extend a deadline. Having this "contract" in writing is desirable.

Evidence of an incomplete remains permanently on the transcript. When the course has been completed, a grade is entered with an asterisk, indicating that it was not completed during the regular semester. Once an engineering student has graduated, any remaining incompletes are permanently frozen on the transcript, and no additional coursework can be completed.

Students should weigh the cost of taking an incomplete against the reasons for doing so. It may be helpful to discuss the matter with a faculty advisor or a staff member in Engineering Advising.

Repeated Courses

All courses taken for letter grade are calculated into the cumulative grade point average. The grade for a course that is repeated, whether successfully or unsuccessfully, does not replace the original course grade on the transcript nor in the calculation of the cumulative grade point average.

Advanced Placement and Transfer Credit

Many students come to Cornell with advanced placement credit for courses taken in high school or with courses taken at an accredited college that are similar to courses offered here. Students who think they are already competent in the subject matter of a course offered at the introductory level can demonstrate their proficiency and receive credit for the course without actually taking it.

There is a difference between advanced placement credit and transfer credit. Advanced placement credit is awarded when a student shows competence in a subject by doing well on an approved exam. Transfer credit is awarded for a course that has been satisfactorily completed at another college and that has not been used to meet high school graduation requirements.

The only courses for which students may obtain advanced placement or transfer credit are those that fit degree requirements in the undergraduate engineering program. The College of Engineering decides whether credit should be awarded for particular courses, and in all cases this decision is final.

Advanced Placement Credit

Students may become eligible for advanced placement credit in four ways:

- By taking a College Entrance Examination Board (CEEB) examination,
- By successfully completing a General Certificate of Education (GCE) Advanced (A-Level) examination,
- By successfully completing an International Baccalaureate (IB) Higher Level examination, or
- By taking a departmental Cornell Advanced Standing Exam (CASE), typically given during Orientation prior to the beginning of the fall term. Some departments may offer CASE exams at other times of the year.

If a student's performance on one of these exams is satisfactory, college credit will be offered.

Advanced placement credit need not be accepted. Choosing to accept credit will depend, in part, on whether a course is a technical course that will be a prerequisite for other courses in a student's academic program. If it is not a technical prerequisite, there is no reason not to accept it. If it is a technical prerequisite, students should make certain that they are really prepared to take the next course in the sequence.

Departmental examinations test technical preparedness, and in this sense, they are better than CEEB AP exams, which may not test for what Cornell expects a student to know. The departmental exam is designed to test the depth of knowledge in the entire range of material customarily covered in a particular course offered at Cornell. Satisfactory performance on such an exam indicates that students already know what they would have learned if they had taken the Cornell course. Satisfactory performance on the CEEB AP exam is not as good an indication that a student knows the entire range of material. When in doubt, students should take a departmental exam, even if they have already passed the CEEB AP exam, provided the department permits.

Since the amount of advanced placement or transfer credit awarded can affect the degree of difficulty of the first year and subsequent success as an engineering student, students should consider the options carefully, seeking advice from their faculty advisors during Orientation and talking with the Undergraduate Coordinator (see pages 10–11) for the primary Major of interest. The first year at Cornell is crucial to the development of an undergraduate program; wise use of advanced placement and transfer credit can make a positive difference.

Acceptable Subjects and Scores

A table showing the most common subjects for which advanced placement credit is awarded in the College of Engineering, and the scores needed on qualifying tests, follows. In mathematics, physics, chemistry, and computer science, advanced placement credit is awarded only for courses required in the engineering curriculum. (The College of Engineering does not award advanced placement credit for statistics.)

Modern Languages

Students can earn advanced placement credit for competence in a foreign language by taking the CEEB AP test or by taking the Cornell Advanced Standing Examination (CASE). Those with a score of 4 or 5 on the CEEB AP test in French, German, Italian, or Spanish will be awarded 3 credits. Qualification for the CASE (in any language) requires at least a 65 on a college placement test (taken either in high school or at Cornell during Orientation). Students achieving a passing score on the CASE will be awarded 3 credits. Language credits, earned via AP or CASE, may be used to satisfy part of the liberal studies distribution requirement (in the foreign language category) or the Advisor-approved elective requirement, contingent on discussion with the faculty advisor.

Other Subjects

Advanced placement credit is granted for many subjects not discussed here. If guidelines for a subject area are not spelled out below, the College of Engineering follows the AP guidelines found in the "General Information" section of *Courses of Study* (http://courses.cornell.edu.)

General Policies for Advanced Placement Credit

The general policies in the College of Engineering governing awards of advanced placement credit are as follows.

1. Advanced placement credit will not be offered in any subject area without a documented examination.

2. All advanced placement examinations are normally taken and scored before fall-term classes begin. Students who take CEEB AP tests in high school should have an official report of their scores sent directly to Cornell as soon as possible. Students who have completed either GCE A-level or IB Higher Level examinations must present the original or a certified copy of their examination certificate to the Engineering Registrar, 158 Olin Hall. Those who wish to take departmental examinations must do so during Orientation.

Advanced Placement Credit Table

Requirements	CEEB AP Exams	GCE A-Level	IB Higher Level
Mathematics 1910 required	4 or 5 on BC	A, B, or C on Math or Pure Math exams	No credit[a]
Physics 1112 required	5 on mechanics portion of C 5 on B with successful completion of a high schoool level calculus course	A or B	6 or 7
2213 required	5 on electricity and magnetism portion of C	---	---
1112 and 2213	---	A or B plus credit for MATH 1910	---
Chemistry 2090[b] 2090 and 2080	5 ---	B A	6 or 7 ---
Computing CS 1110	5 on A	---	6 or 7
Biology 4 credits 8 credits	4 5	--- A or B	6 7
First-Year Writing Seminar (two required) One seminar	5 (English)[c]	A	7

For all other subjects, see *Courses of Study* : http://courses.cornell.edu/content.php?catoid=22&navoid=5774

Notes

a. Students are encouraged to take the Cornell departmental examination during Orientation.

b. Students who obtain advanced placement credit for CHEM 2090 and are thinking of majoring in ChemE should consider enrolling in CHEM 2150. Those who are offered credit for CHEM 2090 and then elect to take CHEM 2150 will also receive academic credit for CHEM 2090. You may want to discuss this option with your faculty advisor.

c. Students receiving a 4 on the CEEB AP English Literature and Composition exam or the CEEB AP English Language and Composition exam, a 6 on the IB Higher Level English exam, or a B on the GCE A-level English exam will be eligible for 3 credits, which may be applied toward the Literature and the Arts category in the liberal studies distribution requirement.

Transfer Credit

General Policies for Transfer Credit

- Only courses that meet degree requirements for the undergraduate engineering program and are deemed equivalent in scope and rigor to courses offered at Cornell will be considered for transfer credit.
- Transfer credit will only be awarded for courses offered by regionally accredited, degree-granting, postsecondary institutions.
- A grade of at least C (not C-) must have been earned in the course being transferred; schools and departments may stipulate a higher minimum grade.
- At most, 18 transfer or Cornell extramural study credits may be applied to engineering degree requirements after a student matriculates at Cornell. (Credit for summer and winter session courses taken at Cornell is not considered transfer credit, nor does it count toward the 18-credit maximum.)
- Credits earned while participating in a pre-approved fall or spring semester study abroad program of study do not count towards transfer credit limits.
- Transfer credit will not be awarded for courses taken during a semester in which a student is enrolled at Cornell.
- Transfer credit will not be awarded for cooperative courses taken while in high school, technical skills, or general knowledge acquired through personal experience, employment, or military training.
- Transfer credit will only be awarded if/when the student has submitted a detailed course syllabus or outline, and a certified copy of the student's official transcript from the host institution (photocopies are not acceptable). Students must also submit a completed Transfer Credit Form.
- Incoming first-year students submit a completed High School Credit Form.
- Credit in excess of that awarded by Cornell for the equivalent course is never granted, nor will Cornell award more than the number of credits completed at another institution. (Transfer credits from institutions on a trimester or quarter system are not directly comparable to semester credits, and will be reduced when converted to semester credits.)
- The final transfer credit award is recorded by the Engineering Registrar, 158 Olin Hall. Grades for courses taken at other institutions do not appear on the official Cornell transcript and are not included in the Cornell cumulative grade point average.

Transfer Credit for Transfer Students

Transfer students entering as first-, second-, or third-year students may transfer up to 36 credits for each year spent in full-time study at another institution, provided that the courses are acceptable for meeting graduation requirements. No more than 72 total transfer credits (combination of those taken both before and after matriculation) may be used to meet graduation requirements. Transfer credits from institutions on the quarter system or trimester system are not directly comparable to semester credits. In general, the number of trimester credits or quarter credits will be reduced when converted to semester credits,

and credit will not be given for more than 10 courses per year. Transfer credit awards for matriculating transfer students are evaluated and determined by the undergraduate Major representative in the student's intended Major of study in engineering.

Transfer students transferring 12 to 23 credits are exempt from one PE course.

Transfer students transferring 24 or more credits are exempt from two PE courses and the swim test.

Transfer Credit to Fulfill the Math Requirement

If transfer credit is given for one or more of the first three math courses (1910, 1920, and 2930 or 2940), the total number of credits for these three courses must be at least 11; otherwise, another math course is required. Transfer credit given for the fourth, Major-dependent, math course must be at least 3 credits.

Transfer Credit for First-Year Students

Students who have taken a course or courses offered by an accredited college or university may wish to transfer the credits and apply them toward course requirements at Cornell.

During the summer months prior to arriving on campus, the Engineering Registrar's office will work directly with students who indicate that they have taken college-level courses at another institution. These students will be provided additional information by email.

To be eligible to receive transfer credit the following must apply:

- Students must have received at least a grade of C (not C–) in the course, and the subject matter must be applicable to the Engineering curriculum at Cornell.
- The Engineering Registrar's office must possess a signed statement (High School Credit Form) from the high school guidance office certifying that the course was not used to fulfill high school graduation credit and that it was taught on a college campus by college faculty and attended by college students. Students who want credit for cooperative courses taken in high school must seek AP credit, not transfer credit.
- An official transcript must be received.
- Transfer credit requests must be completed by the end of the first term of residence.

How to Use Advanced Placement or Transfer Credit

Advanced placement (or transfer) credit enables students to begin their college studies at an advanced level. (Each student must judge their own ability to handle a demanding academic program.) The advisability of accepting credit depends on many personal factors, such as the extent of study skills, the activities students wish to engage in during their first year, and the thoroughness of their preparation. Whether to accept advanced placement—or take the corresponding course—is a decision for which the student, alone, is responsible.

Advanced placement or transfer credit can be used in at least three ways:

- Enrolling immediately in a more advanced course in the same subject area, for example, second-term mathematics in the first term.
- Substituting elective course work during the first year or subsequent year. However, students must meet the criteria for good academic standing.

- Enrolling in fewer courses, using the credit to fulfill basic requirements. (To be in good standing, enrollment in at least 12 credits each semester is still required.)

Further Information

For further information about advanced placement or transfer credit, contact Engineering Advising.

Academic Standing

All students are expected to remain in good academic standing. The criteria for good standing changes somewhat as a student progresses through the four years of the engineering curriculum. At all times, the student must be making adequate progress toward a degree, but what this actually means depends on a student's affiliation status.

Requirements for students not yet affiliated with a Major are listed below. Failure to meet the requirements will result in a review by the faculty Committee on Academic Standards, Petitions, and Credit (CASPAC), which may issue a warning, may require a student to take a leave of absence, or may even require a student to withdraw from the college.

To be in good standing at the end of each semester, unaffiliated students must have:

- At least 12 credits (ENGRG 1050 and AEW's count; other courses below 1100 and PE courses do not count);
- At least two courses (>/= 3 credits each) in required common curricular mathematics, science, and engineering (project teams, research, independent study, ENGRG, and ENGRC's not included);
- At least one ENGRD by the end of the third semester with a grade of at least C-;
- At least a C- in required mathematics courses;
- No more than one grade below C each semester in required mathematics, science, and engineering courses;
- Semester GPA >/= 2.0;
- Cumulative GPA >/= 2.0;
- No F, U, UX or INC grades.

Because mathematics is pivotal to the study and practice of engineering, students must earn at least C– in MATH 1910, 1920, 2930 or 2940, and a math course chosen by the Major. Students failing to meet this requirement must repeat the course and receive a satisfactory grade before enrolling in the next course in the sequence. Failure to achieve at least C– the second time will result in withdrawal from the College of Engineering and possibly from Cornell University. Physics and advanced math courses often have math prerequisites, and having to repeat the prerequisite course may delay progress in the physics and math curricula. Students are expected to continue the sequence of core engineering math courses each semester until completed.

The requirements for good standing in Majors are listed below. Students who are affiliated should consult with their Major department for current requirements.

Criteria for Good Standing in Major Programs

Affiliated students must continue to meet college requirements for good standing as described earlier in this section. In addition, they must meet the following criteria to remain in good standing in their Major:

Biological Engineering

(For all Biological Engineering Majors regardless of the college they are enrolled in)

- Semester GPA ≥2.0
- Cumulative GPA ≥2.0
- Semester GPA ≥2.0 in biological and environmental engineering courses and engineering distribution courses
- Passing grade in at least 12 credits each semester
- No failing grades
- At most, one grade below C- in required core courses, design courses, BE Focus Area electives, and engineering distribution courses can count towards completion of undergraduate Major.

Biomedical Engineering

- Semester GPA > 2.3
- Cumulative GPA > 2.1
- No grade below C- in any Core or Concentration Course required for graduation[1]
- No failing grade
- Minimum of 12 credits per semester completed with passing grades [2]

[1] Only one course below a C- within Major required courses is allowed for graduation.
[2] No course with a grade lower than C- may be used to satisfy a prerequisite for a subsequent BME course.

Chemical Engineering

- Semester GPA ≥2.0
- Cumulative GPA ≥2.2
- GPA ≥2.2 each semester in required chemical engineering courses
- At most, one grade below C– in required chemical engineering courses during the undergraduate program
- No failing grades

Civil Engineering

- Semester GPA ≥2.0
- Cumulative GPA ≥2.0
- Semester GPA ≥2.0 in core courses, design courses, Major-approved electives, and engineering distribution courses (Tech GPA).
- No failing grades.

- Passing at least 12 credit hours each semester
- Cumulatively, no more than one grade below C– in required core courses, design courses, Major-approved electives, and engineering distribution courses.

Computer Science

- Semester GPA ≥2.3
- Semester GPA ≥2.5 in courses required for the CS Major program, with no course grade less than C–
- No failing grades
- A passing grade in at least 14 credits each semester
- Successful completion of at least three of the following CS courses by the end of junior year (CS 2800, CS 3110, CS 3410/3420, CS 4410, CS 4820) and be making adequate progress toward completion of degree
- At most, 2 grades as low as C– allowed in CS core courses and CS 4000+ electives for graduation

Electrical and Computer Engineering

- Semester GPA ≥2.3
- No course with a grade less than C– may be used to satisfy ECE Major requirements.
- Students must satisfactorily complete the following requirements: (a) two of: ECE/ENGRD 2100, ECE 2200, or ECE/ENGRD 2300; (b) all mathematics and physics courses through MATH 2940 and PHYS 2214 by the end of the first semester in the Major (typically the second semester of the second year) and make adequate progress toward the degree in subsequent semesters.
- No failing or missing grades
- Passing grade in at least 12 credits each semester

Engineering Physics

- Semester GPA ≥2.3
- At least C– in all required courses
- No failing grades
- A minimum of 12 credit hours per semester

Environmental Engineering

(For all EnvE Majors regardless of the college in which they are enrolled)

- Semester GPA ≥2.0
- Cumulative GPA ≥2.0
- Semester GPA ≥2.0 in core EnvE courses, design courses, Major-approved electives, and engineering distribution courses
- 12 credit hours each semester
- No failing grades

- At most, one grade below C– can be used to fulfill the EnvE degree requirements in the following four categories: required core courses, design courses, Major-approved electives, and engineering distribution courses.

Independent Major

To be in good standing at the end of each semester, IM students must have:

- At least 12 credits (courses below 1100 and PE do not count)
- At least three courses (≥9 credits total) from the primary and secondary program of study
- No more than one grade below C– each semester
- Semester GPA ≥2.0
- Cumulative GPA ≥2.0
- No F, U, UX or INC grades

The IM Academic Review committee will review IM students' academic progress each semester.

Information Science, Systems, and Technology

- Semester GPA ≥2.0
- Semester GPA ≥2.3 in courses used toward the ISST Major and all mathematics courses required by the Engineering college.
- At least C– in ENGRD 2110, ENGRD 2700, and all courses used toward the ISST Major. Note: For each such course, at least C– is required for the course to count toward graduation requirements. If a lower grade is received, the course must be retaken.
- Satisfactory progress (a minimum of 14 credits per semester)
- No failing grades

Materials Science and Engineering

- Semester GPA >2.0
- Cumulative GPA >2.3
- At most, one grade as low as C– in the Major required courses, materials electives, materials applications electives, and the outside technical elective

Mechanical Engineering

- Cumulative GPA ≥2.0
- Semester GPA ≥2.0
- Satisfactory progress with a minimum of 12 credits each semester

- At least C– in all ME Major required courses except MAE 3780, PHYS 3360, PHYS 2214, MAE 3272, MAE 4272, and MAE 4300. Consult www.mae.cornell.edu for additional academic standards information

Operations Research and Engineering

- Cumulative GPA ≥2.0
- Cumulative GPA ≥2.0 in required Operations Research and Engineering courses
- At least C– in all Operations Research courses, and by the end of the sixth semester, a grade of at least C– in ENGRD 2110
- Satisfactory progress (a minimum of 12 credits per semester)
- No failing grades, no incompletes

Science of Earth Systems

- Semester GPA ≥2.0
- Cumulative GPA ≥2.0
- At least C– in all required courses
- A minimum of 12 credits hours per semester.

Academic Actions

At the end of each semester, the records of all unaffiliated students are reviewed by the faculty Committee on Academic Standards, Petitions, and Credit (CASPAC). The records of students who have affiliated with a Major are reviewed by faculty committees in those departments. Students who fail to meet the conditions for good standing may receive warnings, be required to take a leave of absence, or be withdrawn from the college. (Withdrawal from the College of Engineering may also result in withdrawal from Cornell University.)

A warning should be taken seriously. A student who receives a warning and continues to perform unsatisfactorily may be unable to affiliate or may be withdrawn from the degree program and from Cornell University. Poor performance also diminishes prospects for affiliation, graduation, and post-graduate opportunities. Students should determine what their underlying difficulties are and address them, perhaps with the help of their faculty advisor or the staff in Engineering Advising.

When students fail to make adequate progress in technical courses during a given semester, the review committee may require them to take time off to improve their understanding of the areas in which they are having difficulty. This is known as a required leave of absence. While it will result in a postponement of graduation, we hope it is regarded as an opportunity to address academic deficiencies or personal challenges before rejoining the engineering degree program. Students on a required leave of absence are not permitted to enroll in courses at Cornell. They may choose to go to other institutions to take courses. (See Transfer Credit)

When a student fails to earn a C- or better in the same math course twice, or when a student fails to make sufficient progress towards their degree, the review committee will require the student to withdraw from the College of Engineering. (Students in this situation may wish to investigate other colleges at Cornell, although opportunities to internally transfer may not exist. Cornell Career Services in Barnes Hall is an excellent resource, as is the Office of Internal Transfer in CCC Building. Students who want to continue their study of engineering are advised to seek admission to a different institution.)

Academic Integrity

The *Cornell University Academic Integrity Handbook* is distributed to new and transfer students. The code also appears (along with other campus policies) in the *Policy Notebook for the Cornell Community*, which is published by the Office of the Dean of Students and distributed to new students It is available on the web at cuinfo.cornell.edu/Academic/AIC.html. An explanation of all aspects of academic integrity proceedings is available at www.theuniversityfaculty.cornell.edu/AcadInteg/.

The following is taken directly from the code (refer to the documents mentioned above for the entire code): "Absolute integrity is expected of every Cornell student in all academic undertakings ... Academic integrity is expected not only in formal course work situations but in all university relationships and interactions connected to the educational process, including the use of university resources. A Cornell student's submission of work for academic credit indicates that the work is the student's own. All outside assistance should be acknowledged, and the student's academic position truthfully reported at all times. In addition, Cornell students have a right to expect academic integrity from each of their peers."

The authority to determine whether a specific action shall be treated as a violation of the *Code of Academic Integrity* lies with the Academic Integrity Hearing Board. Those who violate the *Code of Academic Integrity* will be subject to penalties under this code and may also be subject to penalties under state and federal laws.

Students and staff members discovering an apparent violation should report the matter to the faculty member in charge of the course or to the chair of the appropriate Hearing Board. Procedures for dealing with alleged academic integrity violations are outlined in the code.

Dean's List

Dean's List citations are presented each semester to engineering students with exemplary academic records. The criteria for this honor are determined by the dean of the college.

For 2016–2017, the requirement is a semester GPA ≥3.50 (without rounding); no failing, unsatisfactory, missing, or incomplete grades (even in physical education); and at least 12 letter-grade credits (not S/U). Students may earn Dean's List status retroactively if they meet these criteria after making up incompletes. Students who make the Dean's List will have the honor noted on their transcript.

Graduating with Distinction

Meritorious students graduating with a B.S. degree from the College of Engineering may also receive degrees designated as *cum laude*, *magna cum laude*, or *summa cum laude*.

Cum laude is awarded to all engineering students with an overall GPA ≥3.50. Cum laude is also awarded to all engineering students who received a semester GPA ≥3.50 in each of the last four semesters of attendance at Cornell; in each of these semesters, at least 12 letter-grade credits must be taken with no failing, unsatisfactory, missing, or incomplete grades. If the student is an Engineering Co-op student, then the Engineering Co-op summer term will count as one of the last four. Students who were approved for prorated tuition in their final semester will be awarded cum laude if they received

a semester GPA ≥3.50 in their last semester and meet the conditions above in the prior four semesters.

Magna cum laude is awarded to all engineering students with a GPA ≥3.75 (based on all credits taken at Cornell).

Summa cum laude is awarded to all engineering students with a GPA ≥4.0 (based on all credits taken at Cornell).

Note: All GPA calculations are minimums and are not rounded.

Major Honors Programs

To enter a Major honors program, a student must be on track to graduate with distinction. A student must be in the program for at least two semesters before graduation. If the student's Major has an approved honors program and the requirements for (1) distinction, (2) Bachelor of Science degree, and (3) Major honors program are fulfilled, the faculty of the Major may recommend that the student graduate with the notation of "With Honors" on their diploma and transcript.

Biological Engineering (BE) Honors Program

To participate in this Honors Program, students must meet the Major Honors Programs criteria as delineated above, and must have at least 9 credits beyond the minimum required for graduation in BE plus a presentation in a public scholarly research forum. These 9 credits shall be drawn from one or more of the following, with at least 6 credit hours in the first category:

- A significant research experience or honors project under the direct supervision of a BEE faculty member using BEE 4990 (Undergrad Research) and BEE 4993 (Honors Thesis), to be completed in their senior year. A written senior honors thesis must be submitted as part of the second component. A minimum grade of A– in both courses is required for successful completion of the honors requirement. It is expected that the two research courses will be taken in consecutive semesters.
- A significant teaching experience under the direct supervision of a BEE faculty member or as part of a regularly recognized course in the department under BEE 4980: Undergraduate Teaching.
- Advanced or graduate courses. These additional courses must be technical in nature and related to the student's research area (i.e., in engineering, mathematics, biology, chemistry, and physics at the 4000 and graduate level).
- Research Forum. The student must present a poster or oral presentation in a public research forum such as a national or regional professional society meeting, Bio Expo, or another university or regional event by the end of the student's project.

Timing

All interested students must complete a written application (available in 207 Riley-Robb Hall) no later than the end of the third week of the senior year, but are encouraged to make arrangements with a faculty member during the second semester of their junior year. A

student must be in the program for at least two consecutive semesters before graduation.

Procedures

Each applicant to the BE Honors Program must have a BEE faculty advisor to supervise their honors program. A written approval of the faculty member who will direct the research is required.

Biomedical Engineering (BME) Honors Program

To participate in this honors program, students must meet the Majors Honors Programs criteria as delineated above, and must have at least 11 credits beyond the minimum required for graduation in BME (therefore the minimum number of credits to graduate is 141). These 11 credits shall include:

- BTRY 3020 Biological Statistics II – With a grade of at least B+ (4 credits). NOTE: BTRY 3010 is a pre-requisite for BTRY 3020.
- A significant research experience or honors project under the supervision of a BME faculty member using BME 4990 (Undergraduate Research) and BME 4991 (Honors Thesis), to be completed in their fourth year. A written senior honors thesis must be submitted as part of the second component. A minimum grade of A- in both courses is required for successful completion of this honors requirement. The two research courses will be taken in consecutive semesters. (6+ credits)]
- A significant teaching experience under the supervision of a BME faculty member or as part of a regularly recognized course in the department under BME 4980: Undergraduate Teaching. (1+ credits)

In addition:

- The student must present a poster or oral presentation in a public research forum such as a national or regional professional society meeting, Bio Expo, or other public university event by the end of the student's project.
- Project teams are not acceptable for Honors Thesis research unless there is a clearly defined project outside of the team effort attested by the project faculty advisor.
- No research, independent study, or teaching experience for which the student is paid may be counted towards the credits required for the honors program.

Timing

All interested students must complete a written application (available 108 Weill Hall) no later than the end of the third week of their 7th semester, but students are encouraged to make arrangements with a faculty member during their junior year.

Procedures

Each applicant to the BME Honors Program must have a BME faculty advisor to supervise their honors program. Before enrolling into BME 4990, a written application must be submitted to the director for undergraduate studies. This application must include a brief proposal outlining a research topic, the significance of the topic with respect to human health, and the scope of the proposed project or thesis. A written approval of the

faculty member who will direct the research is required to accompany this application. The proposal will be reviewed and either approved, returned back to the student for revision, or rejected. The proposed project must consist of a research, development, and/or design project that fills a clear knowledge or technical gap in the literature. A written report in the format of a technical paper is required at the conclusion of the project. Such reports include sections such as: Introduction, Materials and methods, Results, Discussion, Conclusions. It is expected that the report contain sufficient completeness and detail to be submitted to a peer reviewed journal publication. The report and an associated oral presentation will be evaluated by the BME Honors committee.

Civil Engineering (CE) Honors Program

To participate in this Honors Program, students must meet the Major Honors Programs criteria as delineated above. The program consists of at least 9 credits beyond the minimum required for graduation in CE. These 9 credits shall be drawn from one or more of the following components (with at least 2 credits in any selected component):

- A significant research experience or honors project under the direct supervision of a CEE faculty member using CEE 4000 Senior Honors Thesis (1–6 credits per semester). A significant written report or senior honors thesis must be submitted as part of this component. Letter grade only.
- A significant teaching experience under the direct supervision of a faculty member using a regularly recognized course in the College of Engineering (i.e. CEE 4010 Undergraduate Engineering Teaching in CEE [1–3 credits per semester]).
- Advanced or graduate courses at the 5000 level or above.

No research, independent study, or teaching for which the student is paid may be counted toward the honors program.

Timing

Students must apply no later than the beginning of the first semester of their fourth year but are encouraged to apply as early as the first semester of their third year.

Procedures

All honors program students must be in the program for at least two semesters before graduation. Students must enter with and maintain a cumulative GPA equal to or greater than 3.5. Each applicant to the CEE Honors Program must have a faculty advisor or faculty member to supervise the student's individual program. (This need not be the student's faculty advisor.) Applications can be obtained from Hollister 221. Each program must be approved by the CEE Curriculum Committee, although the committee may delegate approval authority to the associate director for all but unusual proposals.

Computer Science (CS) Honors Program

To participate in this Honors Program, students must meet the Major Honors Programs criteria as delineated above and complete at least (9) credits above the minimum required for completing the major. These nine credits must include:

- At least one CS course (3-credit minimum) at or above the 5000-level with at least A– (no seminars or 2-credit project courses).

- At least two 3-credit semesters of CS 4999: Independent Reading and Research with a CS faculty member with at least an A– each semester.

Content

Honors courses may not be used to satisfy the CS electives, the CS project course, the technical electives, courses in the External Specialization, Major-approved elective, Advisor-approved electives, or a student's first vector. In essence, honors course work represents a depth of work that is well beyond the minimum requirements needed to fulfill the Major.

Timing

Candidates are required to send email to ugrad@cs.cornell.edu with the subject line "Honors Candidate". The deadline for receipt of messages requesting honors is October 15 for May and August candidates and March 15 for January candidates, during or prior to senior year.

Preparation

Arrangements for CS 4999 projects should be made directly with faculty members in the department. Students are encouraged to discuss potential contacts with their advisors and to browse the department's web page at www.cs.cornell.edu/ for specific leads on research opportunities.

Computer Science reserves the right to make changes in this program at any time.

Engineering Physics (EP) Honors Program

To participate in this Honors Program, students must meet the Major Honors Programs criteria as delineated on page 144.

- Courses counting towards honors cannot be applied to the B.S. degree. The student must complete the following two requirements, which must result in at least 9 credits of work beyond the minimum required for graduation in EP:

1. Enroll in Independent Study in Engineering Physics, AEP 4910, which must be taken for a minimum of 6 credits, over two semesters, for the purpose of completing an independent research project or senior thesis under the supervision of a Cornell engineering or science faculty member. The minimum enrollment is two credits in the first semester and four credits in the second. The level of work required for a successful completion of this project or thesis is to be consistent with the amount of academic credit granted.
2. The student must enroll in an additional technical course at the 4000 level or above, for at least 3 credits.

Timing

Complete a written application no later than the end of the third week of the first semester of the fourth year, but it is better to make arrangements with a faculty member during the second semester of the third year.

Procedures

Before enrolling in AEP 4910, submit to the director for undergraduate studies a brief proposal outlining the topic and scope of the proposed project or thesis and a faculty supervisor's written concurrence. This proposal will be reviewed and either approved or returned

to the candidate to correct deficiencies. The proposed research project or senior thesis is to consist of a research, development, or design project and must go beyond a literature search. A written report is required in the form of a technical paper with, for example, an abstract, introduction, methods section, results section, conclusions section, references, and figures. This report will be evaluated by the faculty supervisor and the chair of the EP Honors Committee. Following completion of the written report, an oral report is presented to an audience consisting of the faculty supervisor, the chair of the Honors Committee, and at least one other departmental faculty member, along with the other honors candidates. At least a grade of A– is required for successful completion of the honors requirement.

Environmental Engineering (EnvE) Honors Program

The environmental engineering honors program consists of at least 9 credits beyond the minimum required for graduation in the environmental engineeirng major. These nine credits must be drawn from one or more of the following categories with at least 3 credit hours in the first category:

1. A significant research experience or honors project under the direct supervision of an Environmental Engineering faculty member using BEE 4990 (Undergraduate Research, 3 credits) and BEE 4993 (Honors Thesis, 3 credits) or CEE 4000 Senior Honors Thesis (1 to 6 credits per semester). A significant written report or senior honors thesis must be submitted as part of this component. Letter grade only.
2. A significant teaching experience under the direct supervision of a faculty member using a regularly recognized course in the College of Engineering (i.e., Under graduate Engineering Teaching, BEE 4980 or CEE 4010 [1 to 4 credits per semes ter]).
3. Advanced or graduate courses at the 4000 level or above.

No research, independent study, or teaching for which the student is paid may be counted toward the honors program.

Eligibility: Students must enter with and maintain a cumulative GPA equal to or greater than 3.50.

Application: Students must apply no later than the beginning of the first semester of their senior year, but are encouraged to apply as early as the first semester of their junior year. All honors program students must be in the program for at least two semesters before graduation.

Independent Major (IM) Honors Program

To participate in this Honors Program, students must meet the Major Honors Programs criteria as delineated on page 144 and:

- Complete at least 9 credits above the minimum required for graduation, from courses selected at the advanced or graduate level (excluding credits awarded for research) and approved by the primary area advisor.
- Have a written proposal of the honors project accepted by the primary area advisor and the Independent Major Committee by the beginning of the seventh semester.
- Complete an honors thesis involving research of breadth, depth, and quality and demonstrating professional communication skills.

Information Science, Systems, and Technology (ISST) Honors Program

To participate in this Honors Program, students must meet the Major Honors Programs criteria as delineated on page 144 and:

- Three credit hours of ISST graded course work at least at the 5000 level (no S/U courses; no 1- or 2-credit seminars or 2-credit project courses.)
- Six credit hours of INFO 4900: Independent Reading and Research with an ISST faculty member, spread over two semesters, with at least A– in each semester

or

- Three credit hours of INFO 4900 with an ISST faculty member and 3 credit hours of INFO 4910: Teaching in Information Science, Systems, and Technology, both with at least a grade of A–. It is expected that the INFO 4900 research will result in either a programming project and/or a written report. Courses at the 5000 or 6000 level taken to fulfill the honors requirement may be counted toward fulfillment of the primary or associated option requirements.

The 9 credits work required for honors are in addition to the minimum requirements for the major.

Materials Science and Engineering (MSE) Honors Program

To participate in this Honors Program, students must meet the Major Honors Programs criteria as delineated on page 144 and:

- Complete at least 9 credits above the minimum required for graduation in Materials Science and Engineering, so that the minimum number of credits for an honors degree is 141. The additional courses must be technical in nature, i.e. in engineering, mathematics, chemistry, and physics, at the 4000 and graduate levels, with selected courses at the 3000 level, which must be approved by the Major advisor.
- Enroll in senior thesis (8 credits) and receive at least a grade of A- for both semesters.

Timing

Candidates are required to send email to mmc2@cornell.edu with the subject line "Honors Candidate". The deadline for receipt of messages requesting honors is October 15 for May and August candidates and March 15 for January candidates, during or prior to senior year.

Procedures

A faculty advisor must supervise each student's senior thesis project. Written approval by the faculty member who will direct this research is required.

Operations Research and Engineering (ORE) Honors Program

To participate in this Honors Program, students must meet the Major Honors Programs criteria as delineated on page 144. An honors program shall consist of at least 9 credits beyond the minimum required for graduation in ORE, so that no part of the honors program can also be used to satisfy graduation requirements. The 9 credits shall be from one or more of the following with at least 4 credits from the first category:

- Advanced courses in ORIE at the 5000 level or above.
- A significant research experience or honors project under the direct supervision of an ORIE faculty member using ORIE 4999: ORIE Project. A significant written report must be submitted as part of this component.
- A significant teaching experience under the direct supervision of a faculty member in ORIE using ORIE 4990: Teaching in ORIE.

Timing

Complete a written application no later than the end of the third week of the first semester of the fourth year, though the actual planning for the Honors Program should begin during the first semester of the third year.

Procedures

A faculty advisor must supervise the honors program of each applicant. The honors advisor need not be the student's faculty advisor. The application to the program shall be a letter from the student describing the specific proposed honors program and include the explicit approval of the honors advisor. Each program (as well as any subsequent changes to the program) must be approved by the associate director of undergraduate studies.

Science of Earth Systems (SES) Honors Program

To participate in this Honors Program, students must meet the Major Honors Programs criteria as delineated on page 144 and:

- Complete at least 9 credits above the minimum required for graduation. These credits must be approved by their faculty advisor;
- Have a written proposal of the honors project accepted by their faculty advisor and the director of undergraduate studies, and filed with the Program coordinator;
- Enroll in EAS 4910, EAS 4920, or EAS 4990 (at least 2 credits) for the seventh and eighth semesters of study;
- Complete an honors thesis involving research of breadth, depth, and quality;
- Present the thesis in an oral presentation;
- Obtain final approval by research advisor.

Timing

A written proposal of the honors project must have been accepted by the student's faculty advisor and the director of undergraduate studies by the third week of the seventh semester.

Procedures

A faculty advisor supervises each honors program. Written approval of the proposal or the thesis by the faculty member who will direct the research is required.

Changes in Status

Petitions to the Faculty

A petition is the official way to request consideration of academic matters that are not routine. The petition form, which may be obtained in Engineering Advising, at the Engineering Registrar's office, or online at www.engineering.cornell.edu/resources/registrar/forms.cfm, is used to document the request and decision.

Petitions are required for such purposes as:

- Amending a program of study by adding courses after the 15th calendar day of the semester or dropping courses after the first 57 days of the term;
- Requesting to amend a college curriculum requirement, such as substituting a course or a stated sequence of courses in a degree-requirement area;
- Requesting an exception to a college academic policy based on extenuating circumstances;
- Documenting an advisor's approval of a course towards the Advisor-approved elective requirement.

The petition should include convincing evidence that an exception is warranted.

Students not yet affiliated with a Major should submit their petition to the Engineering Registrar. Affiliated students should check with their Major to determine where to submit their petition.

Time To Degree

Students matriculating in summer 2016 and later must complete all graduation requirements for the Bachelor of Science Degree from the College of Engineering within eight calendar years of a student's initial matriculation in the undergraduate program. Failure to complete requirements within this time period will be deemed unsatisfactory performance and will result in withdrawal from the College of Engineering. In addition, requirements for graduation may be updated if the degree is not completed within five calendar years.

For all students on leave, responsibility for maintaining eligibility to return rests with the student. A student who has been withdrawn may reapply through the College's admissions process; if re-admitted, majors (or the College, if unaffiliated) will determine which credits previously taken will count toward degree requirements.

Leaves of Absence

There are three types of leaves of absence for students in the College of Engineering: voluntary leave of absence, health leave of absence, and required leave of absence. Voluntary and health leaves of absence are for a minimum of six months. Required leaves are for a minimum of one semester.

Students on any type of leave of absence are not permitted to enroll in courses at Cornell during their leave. Students may take courses at other institutions while on a leave. In order to satisfy Cornell degree requirements, courses taken at another institution must be

approved in advance through a formal transfer petition form (see page 136). Credit for courses completed at foreign institutions during a leave of absence will not be accepted for transfer credit unless students are returning to their country of permanent residence during their leave of absence. At most, 18 transfer credits may be used to meet degree requirements after matriculation. See Engineering Advising if you have questions.

Students who are considering taking a voluntary or health leave, as well as those who are placed on a required leave of absence, should check with the Bursar's Office, Office of Financial Aid, Housing and Dining, and Student Employment to find out about financial implications. It is particularly important for students who have educational loans to contact the Office of Financial Aid. Eligibility for medical or auto insurance may also be affected during a student's leave of absence.

Students who are granted a voluntary or health leave of absence during a semester are responsible for any outstanding tuition or other university charges owed through the date of the leave of absence. On-campus housing and dining charges may accrue until the student no longer utilizes the services, regardless of the posted leave date.

Voluntary Leave of Absence (VLOA)

Students sometimes desire to suspend their studies for a period of time (VLOA's are granted for no less than six months and no more than two years). During the semester, a student may request to take a voluntary leave of absence up until the last day of classes. Students who are in good standing in the college at the conclusion of a semester may request to take a voluntary leave of absence to suspend their studies prior to the start of the following semester.

Unaffiliated students request a voluntary leave through Engineering Advising. Affiliated students request a voluntary leave of absence through their Major department. Requests must be in writing, and include: a formal request for a voluntary leave of absence, effective date, CUID#, net id, home mailing address, student name, and original signature with date. **A voluntary leave of absence granted during a semester will be effective on the date the written request is received by Engineering.**

A voluntary leave of absence that is granted between semesters or before the deadline to "drop a course without a W" will result in the current semester being expunged (courses will be removed from student record). Leaves granted after the deadline to "drop a course without a W" and before the last day of classes will result in W's on a student's transcript for the courses in which he/she was enrolled (W's do not impact a student's GPA).

Health Leave of Absence (HLOA)

Students sometimes benefit from taking a leave of absence to address physical or mental health issues (HLOA's are granted for no less than six months and no more than two years). During the semester, a student may apply to take health leave of absence up until the last day of classes. The health leave of absence process is initiated by a student with Gannett Health Services (https://www.gannett.cornell.edu/services/leaveofabsence.cfm). Gannett clinicians assess the student and if deemed appropriate will recommend a health leave of absence to the college. The college may include academic conditions for the leave,

in addition to any conditions set forth by Gannett. The college evaluates the recommendation from Gannett and grants the health leave of absence. **A health leave of absence will be effective on the date stated in the letter from Gannett.**

A health leave of absence that is granted between semesters or between the first day of class and the last day of class in a particular semester will result in the upcoming or current semester being expunged (courses will be removed from student record with no impact on GPA).

Required Leave of Absence (RLOA)

At the end of each semester, the academic records of all students are reviewed. Unaffiliated students' grades are reviewed by the faculty Committee on Academic Standards, Petitions, and Credit (CASPAC) and affiliated students' grades are reviewed by their Major department. Students who do not meet the requirements for good standing may be issued a required leave of absence (RLOA's are issued for no less than one semester). **A required leave of absence will be effective on the date stated in the official notification to the student.**

Rejoining the College After a Leave of Absence

Students who wish to rejoin the college after either a voluntary or required leave of absence should contact the college at least six weeks prior to the beginning of the semester in which they wish to return. Unaffiliated students should contact Engineering Advising and affiliated students should contact their Major department. Students will be asked to complete and submit a "Request to Rejoin" form. If no conditions were imposed at the time of the leave, permission to rejoin will be granted upon satisfactory completion of the "Request to Rejoin" form. Students who were given conditions to meet while on leave will be granted permission to rejoin once evidence has been presented that all conditions have been met. Students who are rejoined will receive written confirmation and be reactivated at the university.

Students who wish to rejoin the college after a health leave of absence must first contact Gannett (https://www.gannett.cornell.edu/services/leaveofabsence.cfm). Once Gannett recommends to the college that a student be rejoined, the student will be asked to complete and submit a "Request to Rejoin" form. If no academic conditions were imposed at the time of the health leave, permission to rejoin will be granted upon satisfactory completion of the "Request to Rejoin" form. Students who were given academic conditions to meet while on the health leave will be granted permission to rejoin once evidence has been presented that all conditions have been met. Students who are rejoined will receive written confirmation and be reactivated at the university.

Affiliated students requesting to rejoin should contact their Major. Majors must accept students in good standing who have successfully completed all appropriate portions of the Common Curriculum, including prerequisites for the Major, and who have met the requirements for affiliation. They are not required, however, to accept rejoining second–year students who are not in good standing or have not made adequate academic progress.

Ordinarily, students who take a leave of absence after affiliating with a particular Major

return to that same Major. However, an affiliated student on leave of absence who wishes to transfer to a different Major at the time of rejoining must apply to the new Major. This process may take a few weeks, so notification of intent to rejoin with a change in Major must be received early. Majors are not required to accept a student who began the third year in another Major and later requested transfer. A student who is not accepted into the new Major must rejoin in the original Major.

All students who are rejoining the college should consult with their faculty advisors prior to finalizing their course selections.

Extramural Students

Students not enrolled full-time who register for individual courses through the School of Continuing Education and Summer Sessions are called *extramural students*. Tuition for extramural study is calculated according to the number of credits; no one may register as an extramural student for more than 11 credits per semester. Extramural students do not have the privilege of health insurance or the use of Gannett Health Services, unions, physical education facilities, or other services for which full-time Cornell students pay a fee. Engineering students on a leave of absence may not take Cornell extramural courses.

In the College of Engineering, credits earned in extramural courses taken in either fall or spring semester are counted as transfer credits. Summer or winter session courses taken at Cornell are not considered transfer credit (see section on transfer credit [page 136] for details).

Students may not enroll in courses extramurally during their last semester of undergraduate enrollment.

Since extramural students are not full-time, they may need to begin paying back student loans while taking classes. The Office of Financial Aid and Student Employment has more information.

The School of Continuing Education and Summer Sessions is located in B20 Day Hall.

Voluntary Withdrawal

Students who voluntarily withdraw from the engineering degree program sever all connection with the college. Unaffiliated students who wish to withdraw should do so through Engineering Advising. Affiliated students should do so through their Major.

A student who fails to register in the first three weeks of the semester, without benefit of a leave of absence or permission for study in absentia, will be deemed to have withdrawn.

A withdrawal that is granted during a semester goes into effect on the day it is requested. If a withdrawal is requested after the 57th day of a semester, the courses in which the student was registered at the time of the request are treated as having been dropped (i.e., a "W" will appear on the transcript for each course). Students are responsible for any outstanding tuition or other university charges owed through that date. On-campus housing and dining charges may accrue until the student no longer utilizes the services.

Students who withdraw from the College of Engineering are eligible to apply for admission to one of the other undergraduate colleges at Cornell. The university's internal transfer process and deadlines must be followed.

Students who have withdrawn but wish to return must make a formal appeal for readmission. This is rarely granted. It is subject to a review of the student's academic background and depends on available space in the college and in the student's Major.

Changing Engineering Majors

Students who have affiliated with an Engineering Major may want to change Majors. Other possible candidates for change of Major are students who are withdrawn from their Major (and, therefore, from the college). Such students may apply to another Major.

Students who transfer into the College of Engineering from another institution are not usually eligible to change Majors for a period of one year.

To apply to change Engineering Majors, complete a Change of Major form. Students must be accepted into the new Major; Majors are under no obligation to accept students who have already affiliated with a different Major.

Internally Transferring to Another College at Cornell

Students interested in applying to transfer within Cornell should consult with their faculty advisor, Engineering Advising, and the Office of Internal Transfer and Concurrent Degrees (OITCD), 200 CCC Building (http://internaltransfer.cornell.edu/).

The advisor at OITCD provides advising that is related to university policies as well as to transfer procedures for each college at Cornell. Students should make an appointment early in the semester in order to understand the requirements for transfer and have time to complete those requirements. Some colleges require attendance at information meetings, a meeting with a faculty member, portfolios, etc.—tasks that may need to be completed prior to the application deadline.

Often students find it necessary to take some coursework in their desired major or college in order to facilitate transferring. Students should consult with Engineering Advising to ensure that they are maintaining good academic standing within the College of Engineering. Withdrawing from all engineering coursework will result in being withdrawn from the College of Engineering, regardless of whether a student is accepted by the target college. The staff at Engineering Advising help students evaluate how to maintain good academic standing while exploring a new interest or taking courses to facilitate transferring.

Before applying to transfer, students may find it helpful to explore the relationship among their interests, strengths, values, majors, and career paths with staff at Cornell Career Services in 103 Barnes Hall (http://www.career.cornell.edu/career/).

Change of Name or Address

Students are responsible for updating their addresses and phone numbers online through *Student Center* on any networked campus terminal. (Public terminals are located outside the University Registrar's office and in many of the campus libraries and residence halls.) This applies to both their home and local addresses. Important correspondence may be delayed by forwarding, and failure to receive mail on time is not a valid excuse for missed deadlines.

Changes of name or social security number should be submitted in writing to the University Registrar's office.

Career and Professional Development

From their first year of study, students need to plan for the next stage of life. Some will obtain additional education or training, while others will seek employment immediately after graduation. The College of Engineering and the university provide support for choosing options.

In addition to career development, students should consider the many aspects of professional and personal development. During the undergraduate years, early participation in student technical societies, as well as professional networking web sites (such as LinkedIn), provide preparation for your next move. Obtaining legal recognition of commitment to the engineering profession may also be important. Students may consider first steps toward professional engineering licensure during the fourth year by taking the Fundamentals of Engineering exam. (Typically apply by April of the third year for the October exam in fourth year).

Career and professional development choices are among the most important of life's decisions. Students are encouraged to seek advice early during their time at Cornell and to give careful thought and attention to the process.

The following information is designed to assist students in their career and professional development.

Deciding on a Career

Deciding on a career path and finding employment takes effort and commitment. Since this process can take much time and effort, the following resources can help.

Career Services at Cornell

Cornell Engineering Career Center

201 Carpenter Hall, 255.5006
www.engineering.cornell.edu/careerservices

The Cornell Engineering Career Center office assists students who are contemplating their career development, whether through employment (full-time entry-level, co-op, or summer) or further graduate study.

The office coordinates an on-campus recruiting program that annually brings 150+ employers to campus to conduct more than 5,000 interviews with engineering students for full-time entry-level, co-op, and summer positions. Also, in conjunction with Cornell Career Services, an extensive list of electronic job postings is maintained on Cornell's CCNet System. The office coordinates seminars on job search and résumé/interview preparation, and counselors are available to discuss career-related issues individually and in group settings.

Engineering Cooperative Education Program

The Engineering Cooperative Education Program (Co-op) provides an opportunity for juniors to gain 28 weeks of paid career-related work experience over a semester and a summer with employers nationwide and beyond. Co-op is an excellent way to explore career interests while acquiring an understanding of relevant career paths. Students must be

enrolled in the College of Engineering (Computer Science and Biological Engineering Majors outside the college are also eligible). In most cases, a GPA >2.7 is required. For more information, please see the *Special Programs* section of this handbook (pages 113–116) or visit www.engineering.cornell.edu/coop.

Cornell Career Services

103 and 203 Barnes Hall, 255.5221
www.career.cornell.edu

Cornell Career Services (CCS) educates students about the career planning and job-search process and promotes linkages between students and employers or graduate and professional schools. CCS offers a broad range of programs and services that complement those provided in Engineering Cooperative Education and Career Services, focusing on five areas:

- Career development—career interest inventories, advising on decisions concerning Majors and careers, and networking opportunities.
- Career information—career library with an extensive collection of print, electronic, audio, and video reference materials on careers and career decision-making; employment; internships; graduate and professional schools; fellowships; and international opportunities to assist students with job searches or applying to graduate and professional schools abroad.
- Job search strategies—job search seminars, career fairs, employer information sessions, mock interviews, and on-campus interviews. A Career Guide (in print and online) provides sample résumés, cover letters, and advice on the job-search process, while Cornell's branded Optimal Resume and Optimal Interview services offer a tool for preparing resumes/cover letters and practicing interview questions. The on-campus recruiting program brings to campus more than 300 employers campus-wide who conduct interviews for positions in the management consulting, financial services, retail, health care, insurance, and other industries.
- Employment information via the CCNet electronic job posting service—on summer jobs, internships, and full-time jobs after Cornell.
- Graduate and professional school, including health careers and fellowships—advising and seminars on the application process, information resources, and Graduate and Professional School Days.

The Cornell Career Services web site provides a calendar of events, extensive career resources, and links to Internet career sites.

Graduate Programs and Professional Study

Students who wish to continue with advanced study at Cornell or another institution should start planning early in the fourth year. They should identify the course of advanced study they wish to pursue and the schools, colleges, and universities they might attend. Peterson's *Graduate and Professional Programs* is a useful tool for identifying potential institutions, with names and addresses of people to contact. Faculty members can often give advice about appropriate schools to consider. If possible, students should visit the graduate and professional schools they are considering.

Three graduate degrees are offered at Cornell Engineering: Master of Science (M.S.), Master of Engineering (M.Eng.), and Doctor of Philosophy (Ph.D.).

The M.S. and Ph.D. Programs

The M.S. degree is a two-year program that combines academic rigor and has a strong research component.

The Ph.D. degree program is research-focused with an emphasis on flexibility and individually-tailored original research. Most students complete the degree in five years.

Students in good standing in the Ph.D. programs generally receive full support during their graduate studies, which covers tuition, health insurance, and a stipend. Support may be in the form of fellowships, teaching assistantships, or research assistantships.

To find out about an M.S. or Ph.D. program at Cornell, visit the appropriate department or school, or visit the College of Engineering Graduate Education web site, www.engineering.cornell.edu/academics/graduate/degrees/index.cfm.

The M.Eng. Program

The M.Eng. degree features intensive, one-year professional programs of study built around core courses, a flexible curriculum design, practical interdisciplinary study, and a project, which offer students advanced training in science, current technology, and engineering design. M.Eng. programs are offered in 15 disciplines. You can find out about these M.Eng. programs by visiting the M.Eng. web site, www.engineering.cornell.edu/academics/graduate/degrees/meng.cfm, or the appropriate engineering department or school.

At the beginning of their senior year, qualified engineering students may request an early admission (by November of the senior year) to the M.Eng. program. The early admit option allows students to get a headstart on their graduate work while still enrolled as undergraduates. Information on early admit is available at www.engineering.cornell.edu/academics/graduate/degrees/meng/early_admit.cfm.

To qualify for early admit, students need at most 8 credits to complete their B.S. degree, have a cumulative GPA ≥ 2.7, and, in the last three semesters of their B.S. program, a GPA ≥ 2.5. The grades of M.Eng. courses taken during the early-admission semester will count toward a student's undergraduate GPA. All requirements for the B.S. degree must be completed before enrolling as a graduate student in the M.Eng. program, and at least one semester as a full-time M.Eng. student is required.

Students interested in pursuing a graduate degree in Engineering at Cornell may also visit the Office of Research and Graduate Studies, 220 Carpenter Hall for more information.

Professional Engineer Licensing

All engineers who offer their services to the public are required to have a valid license to practice. Licensing requirements vary from state to state for the Professional Engineer (P.E.) license (http://ncees.org/licensure/). Obtaining the P.E. license is a multistep process that, nationally, has a common first step of passing the Fundamentals of Engineering exam. Students are eligible for the first step as they near graduation from an accredited engineering degree program.

After passing this exam, the applicant is classified as an Engineer in Training (EIT), and--after serving under a registered engineer for a minimum of four years post B.S. degree (and in some states, after obtaining four years of experience after passing the FE exam)--can then take the Principles and Practice of Engineering (PE) exam, (Part B). Passing this exam in a particular state and in a particular discipline results in licensure from that state.

Student Organizations

Student organizations in Engineering help connect classroom and career, develop professionalism, increase technical proficiency, and refine ethical judgment. Some organizations are involved in community service; many involve teams that compete in intramural soccer, football, hockey, and softball games; and a few manage coffee shops on weekday mornings in the departmental lounges. A complete listing of student organizations is available here: orgsync.rso.cornell.edu

AguaClara
c/o Monroe Weber-Shirk, 265 Hollister Hall
http://aguaclara.cee.cornell.edu

Alpha Epsilon
c/o Professor John March, 202 Riley-Robb Hall
National honor society of agricultural, food, and biological engineering.
https://sites.google.com/site/aedeltacornell/

Alpha Sigma Mu
c/o Professor Shefford Baker, 329 Thurston Hall
Honorary society for students in materials engineering.

American Association of Environmental Engineers (AAEE)
c/o Doug Haith, 308 Riley-Robb Hall

American Indian Science and Engineering Society (AISES)
c/o Diversity Programs in Engineering Office, 146 Olin Hall
http://aip.cornell.edu/cals/aip/student-life/organizations/aises/index.cfm

American Institute of Aeronautics and Astronautics (AIAA)
108 Upson Hall

American Institute of Chemical Engineers (AIChE)
120 Olin Hall, aiche@cornell.edu
www.aiche.org/community/students/chapters/cornell-university-student-chapter

American Society of Civil Engineers (ASCE)
c/o Professor Kenneth Hover, 302A Hollister Hall
Includes Steel Bridge and Concrete Canoe teams.
www.cee.cornell.edu/academics/undergraduate/organizations/asce/

American Society of Mechanical Engineers (ASME)
108 Upson Hall
orgsync.rso.cornell.edu/org/cornellasme

Association of Computer Science Undergraduates (ACSU)
110 Gates Hall
acsu.cornell.edu

Biomedical Engineering Society (BMES)
c/o Professor Chris Schaffer, B57 Weill Hall
Student chapter of the national BMES
www.bme.cornell.edu/about/bmes.cfm

Chi Epsilon
c/o Professor Harry Stewart, 271 Hollister Hall
Student chapter of the national honor society in civil engineering.

Cornell AEP Society (CAEPS)
c/o Professor Chris Xu, 212 Clark Hall
Student organization of the School of Applied and Engineering Physics.

Cornell Chapter of the American Institute of Aeronautics and Astronautics (AIAA)
Committed to advance the state of aerospace science and engineering
http://orgsync.rso.cornell.edu/org/cornellaiaa

Cornell Chapter of the American Meteorological Society (CCAMS)
c/o Mark W. Wysocki, 1114 Bradfield Hall
ccams.eas.cornell.edu/

Cornell Cup USA, presented by INTEL
c/o David Schneider, 612 Rhodes Hall
Creators of the national embedded systems competition at Disney World
www.systemseng.cornell.edu/intel

Cornell Earth Energy Club
c/o Teresa Jordan, 4108 Snee Hall

Cornell Materials Society (CMS)
c/o Professor Michael Thompson, 328 Bard Hall
Undergraduate chapter of the Materials Research Society (MRS), The Materials Information Society (ASM), and The Minerals, Metals, and Materials Society (TMS).

Cornell University Sustainable Design (CUSD)
c/o David Schneider, 612 Rhodes Hall
Dedicated to designing and building innovative energy systems.
www.cusd.cornell.edu; cusd@cornell.edu

Digital Gaming Alliance (DGA)
c/o Walker White, 451 Gates Hall
The video games club at Cornell.
cornellgaming.org/

Earthquake Engineering Research Institute (EERI)
c/o Mircea Grigoriu, 363 Hollister Hall
blogs.cornell.edu/seismicdesignteam/

Encourage Young Engineering Students (EYES)
Public Service Center, 200 Barnes Hall
Committed to increasing the mathematics and science skills of evolving elementary, middle, and high school students.

Engineering Ambassadors Association
102 Hollister Hall
Introduces prospective first-year students to the College of Engineering
www.ea.cornell.edu

Engineering Representative to the Student Assembly
Engineering Student Assembly, Office of the Assemblies, 165 Day Hall

Engineers for a Sustainable World (ESW)
c/o Professor Ruth Richardson, 317 Hollister Hall
Dedicated to building a more sustainable world.
www.sustainablecampus.cornell.edu/initiatives/engineers-for-a-sustainable-world-esw

Engineers Without Borders
c/o Peter Hess, 228 Riley-Robb Hall
orgsync.com/74669/chapter

Eta Kappa Nu (HKN)
c/o Associate Director for ECE, Phillips Hall
Student chapter of the electrical and computer engineering honor society.

Information Science Student Association (ISSA)
c/o Amy Sindone, 110H Gates Hall
infosci.cornell.edu/academics/undergraduate/student-associations/information-science-student-association

Institute of Biological Engineering (IBE)
c/o Mingming Wu
306 Riley-Robb Hall
Student chapter of the national IBE.
orgsync.rso.cornell.edu/org/instituteofbiologicalengineering74103/About

Institute of Electrical and Electronics Engineers (IEEE)
c/o Richard Shealy, 311 Phillips Hall
Student chapter of the national IEEE.

Institute for Operations Research and the Management Sciences (INFORMS)
c/o Cindy Jay, 203 Rhodes Hall
Student chapter of the national INFORMS.

National Society of Black Engineers (NSBE)
c/o Diversity Programs in Engineering Office, 146 Olin Hall
orgsync.com/72399/chapter

Omega Rho International Honor Society
c/o ORE, 203 Rhodes Hall
Student chapter of the Omega Rho International Honor Society.

Out in Science, Technology, Engineering and Math (oSTEM)
c/o Diversity Programs in Engineering, 146 Olin Hall
http://ostematcornell.weebly.com/

Peer Advisor Program
c/o Engineering Advising, 167 Olin Hall
Helps first-year engineering students adjust to life at Cornell and Engineering.

Pi Tau Sigma
108 Upson Hall
Student chapter of the honorary mechanical engineering society.

Science of Earth Systems Student Association
c/o Savannah Williams, 2124 Snee Hall
http://www.geo.cornell.edu/studentorg/SESSA/Welcome.html

Society of Automotive Engineers (SAE)
c/o Professor John Callister, jc62@cornell.edu

Society of Hispanic Professional Engineers (SHPE)
c/o Diversity Programs in Engineering Office , 146 Olin Hall
shpe.cornell.edu

Society of Women Engineers (SWE)
c/o Diversity Programs in Engineering Office, 146 Olin Hall
www.swe.cornell.edu/

Tau Beta Pi
c/o Gennady Samorodnitsky
Student chapter of the national engineering honor society.
http://cornell-tbp.wix.com/nyd-tbp

Women in Computing at Cornell (WICC)
110 Gates Hall
wicc.acm.org

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www.engineering.cornell.edu/advising