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 handy 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 ethnic 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 race, gender, and ethnic diversity to gain a more valuable educational experience and to prepare for the practice of engineering.

Although this handbook embraces 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 and welcome your suggestions for improvement of the handbook.

Fran Shumway
Director, Engineering Advising

Melissa Hutson
Assistant Director, Engineering Advising
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 10–12) 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 ................................................................. 6
College of Engineering Undergraduate Programs Mission .............................. 6
Guide to Important Resources ............................................................................. 8
Undergraduate Major Consultants and Coordinators ...................................... 10
Requirements for the Bachelor of Science Degree ............................................ 13

The Academic Program
College of Engineering Majors .......................................................................... 14
Requirements for Graduation .............................................................................. 14
Residence Requirements ..................................................................................... 20
First-Year Requirements ...................................................................................... 21
Preparing for a Major .......................................................................................... 21
Learning About Majors/Careers in Engineering ............................................... 21

Academic Advising and Student Services
Academic Advising ............................................................................................. 26
Faculty Advising ................................................................................................. 26
ENGRG 1050: Engineering Seminar ................................................................. 28
Peer Advising ...................................................................................................... 28
Preprofessional Advising .................................................................................... 29
Diversity Programs in Engineering .................................................................. 30
Engineering Learning Initiatives ...................................................................... 31
Engineering Registrar ......................................................................................... 32
University Student Records Policy .................................................................... 33

Applying for Major Affiliation ........................................................................ 34
Major Descriptions, Flow Charts, and Check Lists .......................................... 34
Requirements for Major Affiliation .................................................................. 34

Major Programs
Biological Engineering ....................................................................................... 37
Chemical Engineering ......................................................................................... 42
Civil Engineering ............................................................................................... 48
Computer Science .............................................................................................. 54
Electrical and Computer Engineering ............................................................... 59
Engineering Physics ........................................................................................... 64
Environmental Engineering ................................................................................ 68
Information Science, Systems, and Technology ............................................... 74
Materials Science and Engineering .................................................................. 81
Mechanical Engineering ..................................................................................... 86
Operations Research and Engineering ............................................................. 91
Science of Earth Systems .................................................................................. 95
Engineering Minors ................................................................................................................................. 99
Aerospace Engineering ............................................................................................................................... 101
Applied Mathematics ............................................................................................................................... 103
Biological Engineering ............................................................................................................................ 106
Biomedical Engineering ......................................................................................................................... 109
Civil Infrastructure .................................................................................................................................. 112
Computer Science ..................................................................................................................................... 114
Electrical and Computer Engineering ..................................................................................................... 115
Engineering Management ....................................................................................................................... 116
Engineering Statistics ............................................................................................................................ 118
Environmental Engineering .................................................................................................................... 120
Game Design ............................................................................................................................................ 122
Industrial Systems and Information Technology ..................................................................................... 124
Information Science ............................................................................................................................... 125
Materials Science and Engineering ........................................................................................................ 128
Mechanical Engineering ....................................................................................................................... 129
Operations Research and Management Science ................................................................................... 131
Science of Earth Systems ..................................................................................................................... 132
Minor in Business for Engineering Students ....................................................................................... 133

Special Programs

Dual-Degree Option ................................................................................................................................. 134
Double Majors .......................................................................................................................................... 134
The Independent Major ............................................................................................................................ 135
Minor in Business for Engineering Students ........................................................................................ 135
International Engineering Programs ....................................................................................................... 136
Engineering Communications Program .................................................................................................. 136
Engineering Cooperative Education Program ........................................................................................ 137
Undergraduate Research .......................................................................................................................... 137
Leadership and Teamwork Opportunities ............................................................................................. 138
CU Emerge ............................................................................................................................................... 138
Cooperative Programs with The Johnson School at Cornell University ............................................. 138

Course Registration

Registration .................................................................................................................................................. 141
The Course Add/Drop Form ...................................................................................................................... 141
Adding a Course ....................................................................................................................................... 142
Dropping a Course ................................................................................................................................... 142
Changing a Grade Option ....................................................................................................................... 142
Changing Credit Hours ............................................................................................................................ 143
Course Pre-Enrollment Through CoursEnroll ..................................................................................... 143
Maximum Number of Credits per Semester .......................................................................................... 144
Special Courses ....................................................................................................................................... 144

Grades and Credit

Grades ....................................................................................................................................................... 146
Advanced Placement and Transfer Credit ............................................................................................. 148
Academic Standing ........................................................................................................................................ 154
Criteria for Good Standing in Major Programs .................................................................................... 155
Academic Actions ..................................................................................................................................... 158
Academic Integrity .................................................................................................................................... 158
Class Ranking ............................................................................................................................................... 159
Dean’s List .................................................................................................................................................. 159
Graduating with Distinction ....................................................................................................................... 159
Major Honors Programs ............................................................................................................................. 160

Changes in Status
Petitions to the Faculty ............................................................................................................................. 167
Leave of Absence ......................................................................................................................................... 167
Extramural Students ..................................................................................................................................... 168
Withdrawal .................................................................................................................................................. 168
Rejoining the College After a Leave of Absence ....................................................................................... 168
Transferring from One Engineering Major to Another ........................................................................... 169
Transferring to Another College at Cornell ............................................................................................ 170
Change of Name or Address ...................................................................................................................... 171

Career and Professional Development .................................................................................................. 172
Deciding on a Career ................................................................................................................................. 172
Career Services at Cornell .......................................................................................................................... 172
Graduate Programs and Professional Study ............................................................................................. 174
Graduate Programs in Engineering at Cornell ......................................................................................... 174
National GEM Consortium ....................................................................................................................... 176
Professional Development and Lifelong Learning .................................................................................... 176
Professional Engineer Licensing ................................................................................................................ 177

Engineering Awards .................................................................................................................................. 178
Student Organizations ................................................................................................................................. 183
Index ............................................................................................................................................................ 192
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.
Guide to Important Resources

College of Engineering

Office of the Dean, 242 Carpenter Hall, 255.9679
Associate Dean for Undergraduate Programs, 167 Olin Hall, 255.8240
Assistant Dean for Student Services, 167 Olin Hall, 255.8240
Career Services, 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 Communications Program, 425 Hollister Hall, 255.8558
Engineering Learning Initiatives, 167 Olin Hall, 255.9622
Engineering Library, Carpenter Hall, 255.5933
Engineering Registrar, 158 Olin Hall, 255.7140

Personal Counseling Services

Campus Life, 2336 South Balch Hall, 255.5511
Cornell United Religious Work, Anabel Taylor Hall, 255.4214
Counseling and Psychological Services, ground floor, Gannett Health Center,
  255.5208
Diversity Programs in Engineering, 146 Olin Hall, 255.6403
EARS (Empathy, Assistance, and Referral Service), 211 Willard Straight Hall,
  255.EARS
Engineering Advising, 167 Olin Hall, 255.7414
International Students and Scholars Office, B50 Caldwell Hall, 255.5243
Let’s Talk Walk-in Service, 167 Olin Hall, Tuesday, 2:30–4:30 p.m.
Office of Equal Opportunity, 234 Day Hall, 255.3976
Student Life Union, 401 Willard Straight Hall, 255.6839
Suicide Prevention and Crisis Service, Ithaca, NY 14850, 272.1616 (24 hrs.)

Tutorial and Academic Support Services

Behrman Biology Center, 216 Stimson Hall, 255.7429
Center for Learning and Teaching, 420 Computing and Communications Center,
  255.6310
Department of Computer Science, 303 Upson Hall, 255.0982
Diversity Programs in Engineering, 146 Olin Hall, 255.6403
Engineering Advising, 167 Olin Hall, 255.7414
Engineering Learning Initiatives, 167 Olin Hall, 255.9622
Mathematics Support Center, 256–258 Malott Hall, 255.4658
Writing Workshop, 174 Rockefeller Hall, 255.6349
Career and Professional Development Services

Engineering Career Services, 201 Carpenter Hall, 255.5006
Engineering Cooperative Education Program, 201 Carpenter Hall, 255.5006
Master of Engineering Program, 222 Carpenter Hall, 255.7413
University Career Center, 103 Barnes Hall, 255.5221

Other Resources

Bursar’s Office, 260 Day Hall, 255.6413
Campus Life, 2336 Balch Hall, 255.5511
Continuing Education and Summer Sessions, B20 Day Hall, 255.4987
Dean of Students Office, 401 Willard Straight Hall, 255.6839
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
Internal Transfer Division, 220 Day Hall, 255.4386
International Students and Scholars Office, B50 Caldwell Hall, 255.5243
Judicial Administrator, 500 Day Hall, 255.4680
Office of Minority Educational Affairs (COSEP), 100 Barnes Hall, 255.3841
Ombudsman, 118 Stimson Hall, 255.4321
Student Disability Services, 4th floor, Computing and Communications Center,
255.4545
University Registrar, B7 Day Hall, 255.4232, univreg@cornell.edu
Undergraduate Major Consultants and Coordinators

Biological Engineering (BE)
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Civil Engineering (CE)
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Environmental Engineering (EnvE)
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Michael Walter
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Brenda Marchewka
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Mechanical Engineering (ME)

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Nanette Peterson
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108 Upson Hall, 255.3573

Operations Research and Engineering (OR&E)

Robert Bland
bland@orie.cornell.edu
233 Rhodes Hall, 255.9144

Cindy Jay
cjh6@cornell.edu
203 Rhodes Hall, 255.5088

Science of Earth Systems (SES)

John Cisne
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2102A Snee Hall, 255.3698
Requirements for the Bachelor of Science Degree

1. Mathematics  
   MATH 1910, 1920, 2930 or 2940, and a mathematics course chosen by the Major.  

2. Physics  
   PHYS 1112 and 2213, and, depending on the Major, either PHYS 2214 or a designated mathematics or science course. Majors in ChemE, CS, SES, and the Environmental Engineering Option in BE may substitute CHEM 2080 for PHYS 2214. Majors in CE may substitute CHEM 2080 or CHEM 1570/3570 for PHYS 2214. Majors in OR&E may substitute CHEM 2080, CS 2800, or MATH 2930, 3040, 3110, or 3360 for PHYS 2214. Majors in BE and EnvE, and students in the Environmental Engineering Concentration of CE must take CHEM 1570/3570 instead of PHYS 2214.  

3. Chemistry  
   CHEM 2090. Majors in ChemE, OR&E, SES, or those planning on a health-related career should take CHEM 2090 and then 2080. Students in EnvE, the Environmental Engineering Option in BE, or the Environmental Engineering Concentration of CE should take CHEM 2090 and CHEM 1570/3570.  

4. First-year writing seminars (two courses)  
   6  

5. Technical writing requirement (see page 15)  
   3  

6. Computing (CS 1110, 1112, 1113, or 1114 followed by CS 1130 or CS 1132)  
   5  

7. 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. Liberal studies distribution (six courses)  
   18  

9. Approved electives (two courses)  
   6  

10. Major program  
    a. Major-required courses  
       ≥30  
    b. Major-approved electives  
       9  
    c. Courses outside the Major  
       9  

From 124 to 134 credits are required for graduation. The exact number depends on the Major; the specific requirements for each Major are given on the following pages. In addition, all students must complete two terms of physical education and pass the swim test, preferably in the first year.
The Academic Program

College of Engineering Majors
In the first two years, students in the College of Engineering take a set of courses designed to provide a firm foundation for later specialization. This set of courses conforms to the Common Curriculum, which is established by the College Curriculum Governing Board (CCGB) and administered through Engineering Advising. During the second year, students choose and 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)
- 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 (OR&E)
- 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 a grade of C– in MATH 1910, 1920, 2930 or 2940, and a mathematics course chosen by the Major. Students who do not meet this requirement the first time they take a course must immediately repeat the course and earn a satisfactory grade. Students may 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 dismissal 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 must earn at least a grade of C– in MATH 1910 before taking PHYS 1112. Similarly, at least a grade of C– is required in each subsequent mathematics 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 for PHYS 2214).

Category 3. Chemistry

Students who do not intend further study in chemistry should enroll in CHEM 2090 during either semester of the first year. Students are required to receive credit for CHEM 2090 either through AP credit or by successful completion of the course. Students choosing the CHEM 2090 and then 2080 sequence must enroll in CHEM 2090 during the fall semester of the first year so that they may enroll in CHEM 2080 during the spring term.

Category 4. Computing

Introduction to Computing (one of CS 1110, 1112, 1113, or 1114), is taken in the first year, followed by either CS 1130 or 1132, to fulfill the computing requirement. If the first course is Java-based, the second course must be MATLAB-based, and vice versa. The second course should be completed by the end of the second year.

Before taking CS 1110, 1112, 1113, or 1114, some students take CS 1109: Fundamental Programming Concepts, which is offered in the summer only. 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 in the humanities, social sciences, and expressive arts.

These courses, which offer the benefits of small class size, provide an opportunity to practice writing English prose.

Category 6. Technical Writing

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/.

1. ENGRC 3350 or 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:
   - AEP/ENGRD 2640: Computer-Instrumentation Design
   - CHEME 4320: Chemical Engineering Laboratory
   - MSE 4030/4040 (both): Senior Materials Laboratory I and II
   - MSE 4050/4060 (both): Senior Thesis I and II
   - MAE 4272: Fluids/Heat Transfer Laboratory
   - BEE 4730: Watershed Engineering with co-registration in BEE 4930: Technical Writing for Engineers
   - BEE 4890: Entrepreneurial Management for Engineers

4. ENGRC 3020, 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 3020. (May be taken more than once, with different courses, by permission of engineering instructor.)

5. COMM 2630: Organizational Writing, or COMM 3520: Science Writing for the Mass Media, 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 the engineering college. 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 third semester. Some Majors may require additional distribution courses, taken after a student affiliates with a Major. All 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:
   - ENGRI 1200: Introduction to Nanoscience and Nanoengineering (fall, spring)
   - ENGRI 1100: Lasers and Photonics (fall)
   - ENGRI 1101: Engineering Applications of Operations Research (fall, spring)
   - ENGRI 1110: Nanotechnology (fall)
   - ENGRI 1120: Introduction to Chemical Engineering (fall)
ENGRI 1220: Earthquake! (spring)
ENGRI 1130: Water Treatment Design (spring)
ENGRI 1160: Modern Structures (fall)
ENGRI 1170: Introduction to Mechanical Engineering (fall)
ENGRI 1180: Design Integration: DVDs and iPods (spring)
ENGRI 1190: Biomaterials for the Skeletal System (fall)
ENGRI 1260: Introduction to Signals and Telecommunications (spring)
ENGRI 1270: Introduction to Entrepreneurship and Enterprise Engineering (spring)
ENGRI 1610: Computing in the Arts (fall)
ENGRI 1670: Visual Imaging in the Electronic Age (fall)

Two engineering distribution (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 3200: Engineering Computation
   - ENGRD 3220: Introduction to Scientific 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: Mechanics of Solids
   - ENGRD 2030: Dynamics

Majors in Engineering Physics may substitute AEP 3330: Mechanics of Particles and Solid Bodies for ENGRD 2030.

4. Probability and Statistics
   - ENGRD 2700: Basic Engineering Probability and Statistics

Majors in Electrical and Computer Engineering may substitute ECE 3100: Introduction to Probability and Random Signals for ENGRD 2700. Majors in Engineering Physics may substitute ECE 3100 or 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.
5. Electrical Sciences
   ENGRD 2100: Introduction to Circuits for Electrical and Computer Engineers
   ENGRD 2300: Introduction to Digital Logic Design
   ENGRD 2640: Computer-Instrumentation Design

6. Thermodynamics and Energy Balances
   ENGRD 2190: Mass and Energy Balances
   ENGRD 2210: Thermodynamics

7. Earth and Life Sciences
   ENGRD 2010: Introduction to the Physics and Chemistry of the Earth
   ENGRD 2510: Engineering for a Sustainable Society
   ENGRD 2600: Principles of Biological Engineering

8. Biology and Chemistry
   BLOG 1101 and 1103: Biological Sciences, Lectures and Laboratory
   BLOG 1105: Introductory Biology
   BLOG 1107: General Biology
   CHEM 3890: Honors Physical Chemistry I
   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. A minimum of six courses (totaling at least 18 credits) is 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 six groups.
- 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/programs/undergraduate-education/degree-requirements/liberal-studies.cfm) or visit Engineering Advising, 167 Olin Hall, for complete lists of additional approved courses and unacceptable courses.

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.

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)
Courses in this area teach language skills, including reading, writing, listening, and spoken non-English languages, at beginning to advanced levels.
Category 9. Electives

Six credits of approved electives are required and must be approved by the student’s faculty advisor. Because these courses should help develop and broaden the skills of the engineer, advisors will generally accept the following as 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 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.)

Students are free to take as many courses offered at the university in addition to the minimum engineering curriculum requirement as they wish 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 37–98. They include:

1. Major-required courses, i.e., courses in the Major itself.
2. Major-approved electives (9 credits).
3. Major-complementary courses (9 credits). These courses, taken outside the Major, ensure breadth of engineering studies.

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 leave may not take Cornell extramural courses. Exceptions are granted in extraordinary circumstances with permission from Engineering Advising. At most 18 credits earned through extramural study 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. 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, who can provide information on credit evaluation policies and assist in the petitioning process.
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: CHEM 2090, CHEM 2080 (if required for Major), PHYS 1112, 2213, 2214 (depending on Major);
- One of CS 1110, CS 1112, CS 1113, and CS 1114;
- Two (2) first-year writing seminars;
- One (1) intro-to-engineering course (ENGRI designation);
- Two (2) physical education courses

Preparing for a Major

Some Majors begin with courses that cannot be taken without prior 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 34–36 in this handbook and in Courses of Study.

Learning About Majors/Careers in Engineering

ENGRG 1050: Engineering Seminar

All first-year students are pre-enrolled in a section of ENGRG 1050: Engineering Seminar. This 1-credit fall course gives first-year students an opportunity to get to know their faculty advisors on a more personal level. Meeting regularly with their advisees gives advisors an opportunity to learn about each student, to assist in resolving problems as they arise, and to help new students adjust to the demands of the engineering curriculum.

Activities in ENGRG 1050 may include discussion of engineering careers, active research in the college and engineering in general, ethics, and workshops on study and exam skills useful to engineering students. Practicing engineers, advising staff, and faculty members from different disciplines may join the group from time to time.

Faculty Advisors

Every student in the College of Engineering is assigned a faculty advisor. The advisors can help students learn about engineering through the ENGRG 1050 seminar, through one-on-one meetings, and through informal activities sponsored by the college, departments/schools, and student organizations. For more information on faculty advisors, see page 26.
Peer Advisors

Each ENGRG 1050 section has one or two peer advisors—second-, third-, and fourth-year students who have volunteered to help new students understand the course selection process, meet other engineering students, and adjust to life at Cornell. They can offer useful information about courses, tips on studying, student activities, organizations, and other need-to-know facts about campus life from a student’s point of view.

National Engineers Week

The Engineering Student Council (ESC) initiated the celebration of National Engineers Week at Cornell University in 1998. During February, the ESC coordinates seven days of events organized by the council and other engineering-affiliated groups, including the following:

Engineering Day at the Mall

Cornell engineering organizations staff booths to help children in the Ithaca community learn about science and engineering concepts.

Diversity Dinner

In cooperation with the National Society of Black Engineers (NSBE), The Society of Hispanic Professional Engineers (SHPE), and the Society of Women Engineers (SWE), the ESC coordinates a dinner to celebrate cultural diversity in the college. The event includes faculty, administration, and corporate speakers, as well as student entertainers.

Major Information Fair

In October, students may attend the information fair sponsored by Engineering Advising. The fair gives unaffiliated students an opportunity to explore a variety of Engineering Majors by learning about each Major’s curriculum, curricular requirements, research, and career opportunities.

Alumni

The Cornell Engineering Alumni Association (CEAA) is the alumni association for the College of Engineering. Founded in 1903, the CEAA has grown into a major support organization for the college. Nearly two thousand alumni maintain their connection to the college through membership in the CEAA.

The CEAA serves as a link between the college and its alumni by:

- introducing first-year students to young engineering professionals during Alumni Speakers Week in their ENGRG 1050 sections.
• providing ongoing opportunities for networking through regional alumni programs and the annual Engineering Conference.

• sponsoring an innovative project to assist engineering alumni with career development.

• sponsoring the Enterprise Engineering Seminar, which brings alumni back to campus as speakers.

• supporting prestigious awards for excellence in teaching and outstanding student groups.

Engineering Student Project Teams
Students can get involved in many projects that exist within the college, usually for credit. These include the following, with sponsoring disciplines in parentheses:

• AguaClara (Civil and Environmental Engineering)
• ASCE Concrete Canoe Competition (Civil Engineering)
• CUSAT Nanosatellite (Mechanical and Aerospace Engineering)
• Engineers for a Sustainable World (Electrical and Computer Engineering)
• Programming Contest (Computer Science)
• SAE Formula Race Car (Mechanical Engineering)
• Solar Decathlon (Mechanical and Aerospace Engineering)

Undergraduate-Major Consultants and Associate Directors
A faculty member serves as associate director or undergraduate-Major consultant of each Engineering Major. This faculty member is responsible for managing the Major. Major consultants can be valuable sources of information for students who want to learn more about their respective undergraduate Majors.

Engineering Student Organizations
Each Engineering Major has at least one student organization. In addition, there are student chapters of the American Indian Science and Engineering Society (AISES), the National Society of Black Engineers (NSBE), the Society of Hispanic Professional Engineers (SHPE), and the Society of Women Engineers (SWE), which are open to all students. A list of engineering student organizations begins on page 183.

The Sundial
The Sundial is e-mailed to students every week during the regular semester. This electronic publication provides important information that students should be aware of and includes events in the college that can help students learn about engineering. Such events include speakers on engineering topics, company information sessions, student organization activities, and career services offerings.
Printed Material from Majors

Majors produce undergraduate handbooks for use by their students. In addition to required course work and options specific to the Major, many Major handbooks include information on the corresponding engineering discipline(s). Handbooks can be obtained from the undergraduate Major offices.

Web Pages—Majors, Faculty, Students

The College of Engineering web site, www.engineering.cornell.edu, has links to the web sites for the individual departments and/or schools of engineering at Cornell. These web sites provide information on the undergraduate and graduate programs as well as links to faculty, graduate student, and research pages.

Career Services Library

A collection of books, directories, hard copy and electronic job bulletins, and audio/videotapes is available to help students investigate career options and prospective employers. The main library is located at the Cornell Career Services office, 103 Barnes Hall. Engineering Cooperative Education and Career Services (201 Carpenter Hall) also maintains a small collection of supplementary guides and directories. Employer literature supplied by firms that recruit on campus, available at both the university and college facilities, can help students prepare for interviews.

Networking

Talking to friends and acquaintances who are engineers is a good way to learn about the personal experiences of people in the profession. Students are encouraged to visit with practicing engineers and to ask questions that can help them learn about both the positive and more challenging aspects of being an engineer.

Engineering Career Fairs

Cornell Career Services coordinates a two-day career fair in mid-September. One of these days is designated as an engineering/technical career event.

In cooperation with Engineering Cooperative Education and Career Services, the Engineering Student Council (ESC) also coordinates a spring career fair for full-time, internship, and co-op recruitment in February.

Summer Internships

Engineering Cooperative Education and Career Services (201 Carpenter Hall), in conjunction with Cornell Career Services (103 Barnes Hall), receives listings for summer jobs during the academic year. Job listings for students are placed on the CornellTRAK link of the Cornell Career Services web site at www.career.cornell.edu/students.
Externships

Students can obtain an insider’s view of a career Major by shadowing Cornell alumni at their workplaces during January break. The FRESH Externship program is offered exclusively for first-year students during the March spring break. Through externships, students can observe the day-to-day activities of their Cornell sponsor, discuss specific careers with alumni and their colleagues, and obtain limited hands-on experience.

Externships are available in various industries and geographic locations. Externships, determined by the sponsor, are generally from one to several days long.

For more information on externships, visit www.career.cornell.edu/careerConnections/default.html and select either “Extern Program” or “FRESH.”
Academic Advising and Student Services

Academic Advising
From the time students enter the college until they become affiliated with a Major, they are under the administration of Engineering Advising, which implements the academic policies of the College Curriculum Governing Board (CCGB). Engineering Advising provides a variety of advising services to help first- and second-year students with academic, career, and personal matters. Students can make an appointment by calling 255.7414 or may stop in to see an advisor on a walk-in basis.

Engineering Advising is responsible for a variety of programs and services that assist in the development of successful engineering students. These include publishing The Sundial, a weekly e-mail newsletter for students that provides information about upcoming deadlines and special programs; organizing the Major Information Fair and other events to help first- and second-semester students choose a Major; coordinating the Peer Advisor Program; sending early-intervention communications to students who may need additional support in specific courses; and providing information on tutoring and academic support services available on campus.

Faculty Advising
All students are assigned a faculty advisor when they begin their course of study in the College of Engineering. They usually keep that advisor until they affiliate with a Major, even though the advisor may not be in the Major in which they intend to specialize. Once students choose a Major, they are assigned a faculty advisor from that Major.

Faculty advisors help students translate their interests into an appropriate course of study, evaluate their curriculum and workload, monitor their progress toward a degree, and take advantage of the diverse opportunities available at Cornell. Students should consult their faculty advisor when they have questions about the academic requirements of the university, the college, or the schools and departments. Faculty advisors evaluate each semester’s program, approve course changes, and approve any course to be used as an approved elective. Students must see their faculty advisor whenever they consider adding or dropping a course. Students who wish to petition for an exception to college rules should discuss the matter first with their advisor, who must sign any petition before it can be considered.

To be effective, a faculty advisor must be aware of a student’s academic and personal goals. Students should make appointments to see their advisors as soon as they return to campus after intersession or summer vacation. This is an opportunity for the student and advisor to discuss the student’s goals, reevaluate academic plans, and make changes in course enrollment, if necessary. Students must also consult with their faculty advisors during the pre-registration period to receive approval of their course selections for the following semester.

Students are responsible for staying in contact with their faculty advisor and ensuring that the advisor is aware of their goals and progress. Academic difficulties may be avoided if the advisor is able to recognize problems early. Students often form strong
intellectual bonds with their faculty advisors, and this is more apt to happen if the student takes the initiative. Another benefit of developing a relationship with the faculty advisor (and faculty members in general) is that students may wish to ask the advisor for a letter of recommendation at some point in their career. Such letters are not particularly useful unless they come from people who know the student well enough to accurately assess their capabilities.

What Students Should Expect from Their Advisor

• Advice. Students should use their advisors as resources for planning their academic program and identifying academic and career goals. The advisor will be able to explain college degree requirements, scheduling/registration procedures, and other academic regulations. While it is not the function of advisors to help students find employment, they should be able to give broad advice on careers in engineering and science and the academic background necessary for such careers. Advisors can also provide information on postgraduate education and general requirements for admission to graduate programs. A faculty advisor may refer a student to other faculty members or offices that are better able to serve the student’s needs.

• Assistance. Advisors can help students explore special programs, such as cooperative education, international study, dual-degree, and double-Major programs. They may also be helpful in obtaining tutorial assistance or transfer/advanced placement credit, as appropriate. Students often ask their advisors to provide letters of recommendation for scholarships, 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. Advisors who are out of town for more than a week will usually designate an alternative advisor to handle urgent problems.

• Personal Contact. Students should expect to have personal relationships with their advisors, through which the advisors will become familiar with the students’ backgrounds, academic records, and career plans.

What Students Should Not Expect from Their Advisor

• Assessment of Effort Required for Specific Courses. Advisors can determine the appropriateness of a given course in a student’s program, but they cannot predict how difficult the course will be or how much effort it will require.

• Help with Personal Problems. Students should make their advisors aware of problems that interfere with academic progress, but advisors are not trained to provide counseling for personal problems, nor should they be expected to resolve housing or financial issues. They will, however, refer students to the appropriate university office or program.

• Job Search Assistance. While students should be able to discuss career options with their advisors, it is not the advisor’s responsibility to provide assistance in
a job search. Students should contact Cornell Career Services in Barnes Hall or the Engineering Cooperative Education and Career Services office in Carpenter Hall for help in finding employment.

• Tutoring/Study Skills. Advisors are often able to 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 the Learning Strategies Center.

Student Responsibilities in the Student–Advisor Relationship

• Accept Referrals. Students should be willing to accept referrals from their advisors and should review the results of such referrals with their advisors after the fact.

• Initiate Contact. Students are expected to initiate contact with their 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 urged to plan ahead and initiate contact with their advisors well in advance of specific deadlines.

• Keep Advisors Informed. Advisors can provide better advice if they are kept informed of their advisees’ academic progress and career goals. Students should feel free to share this information with their advisors and can expect that their advisors will ask questions and provide appropriate guidance based on the dialogue.

• Work to Develop Rapport. The rapport necessary for good advising can occur only if both the advisor and the student make an active effort to develop it. Recognizing that individual advisors have their own styles and personalities, students should respond to the efforts of their advisors to get to know them and their academic interests.

ENGRG 1050: Engineering Seminar

ENGRG 1050: Engineering Seminar, a 1-credit fall course, provides an opportunity for first-year students to get to know their faculty advisors on a more personal and meaningful level. Students meet regularly (as a group) with their faculty advisor to discuss a range of engineering topics. Discussions may include the engineering curriculum, aspects of engineering careers, active research in the college and engineering in general, and study and examination skills useful to engineering students. Groups may also visit campus academic, engineering, and research facilities. All first-year students are preregistered in a section of ENGRG 1050.

Peer Advising

Each ENGRG 1050 section has one or two peer advisors—second-, third-, and fourth-year students who have volunteered to help new students understand the course selection process, meet other engineering students, and adjust to life at Cornell. Incoming first-year students meet their peer advisors during orientation
week and as part of ENGRG 1050. Subsequent meetings are arranged as needed. Students should feel free to e-mail their peer advisors whenever they have questions.

Preprofessional Advising

Students who intend to go on to graduate study in law, medicine, or business have access to resources and services designed specifically to support their professional aspirations. The principal function of these services is to disseminate information and coordinate visits by admissions personnel. Students considering any of these graduate fields should visit Engineering Advising for general guidance and more detailed information.

Premedical

Students interested in medicine or other health-related careers must plan their courses early to meet both the requirements of the Common Curriculum and the prerequisites of the intended professional course of study. Advice for first- and second-year premed students is provided by Engineering Advising, 167 Olin Hall, and by Judy Jensvold, the university pre-med advisor, in her annual pre-med meetings for engineers.

For third- and fourth-year students, pre-med advising is handled exclusively through the university’s Health Careers Programs office. Students must declare their intentions through that office in the fall of their third year.

Important meetings and deadlines are advertised in The Sundial, the Cornell Daily Sun, and special bulletins published by the Health Careers Programs staff at the Cornell Career Services office in 103 Barnes Hall.

Prelaw

Preparation for law school does not require a special structured curriculum, but students are encouraged to take electives in history, economics, government, and other courses that emphasize reading, writing, and oral communication. Prelaw advising is provided by Cornell Career Services in Barnes Hall. During the academic year, this office conducts information sessions for students who want to learn more about the legal profession and admission to law school.

Prebusiness

Students who want to prepare for business school should take electives in economics, human-resource management, business management, law, behavioral science, investments, or accounting. Special programs offered by the Johnson Graduate School of Management make it possible to work toward degrees in both engineering and management at the same time (see pages 138–139 for more information). Students interested in these options should visit the Office of Research and Graduate Studies (221–223 Carpenter Hall) or the admissions office of the Johnson Graduate School of Management in Sage Hall.
Diversity Programs in Engineering

The Diversity Programs in Engineering (DPE) office operates programs at the undergraduate, graduate, and faculty levels to facilitate the outreach, recruitment, retention, and overall success of underrepresented minorities, women, and other underrepresented groups in Engineering. DPE is responsible for fostering a vision of diversity appreciation reflective of the College of Engineering’s strategic plan, which enables students from all backgrounds and cultures to thrive and succeed at Cornell. DPE provides an institutionalized approach to meeting the needs of students by coordinating and planning educational, professional development, and networking opportunities that enhance interaction and learning across groups. Through intentional programming and training, DPE assists the college in understanding, appreciating, and celebrating Cornell’s rich cultural diversity. For further information, please contact DPE at 255.6403 or stop by 146 Olin Hall. Some of the current programs are listed below.

Engineering Summer Scholars Program (ESSP)

The College of Engineering participates in a university-wide effort to promote academic achievement and involve students in the life of the university through this six-week prefreshman residential program. The program is designed to acquaint entering students with the challenges and rewards associated with the Cornell Engineering curriculum that will begin in the fall.

Participants enroll in an Engineering Math, Computer Science, and Engineering career exploration seminar.

Trips and recreational activities provide opportunities for getting a better understanding of how to navigate and adapt to the college. Seminars and workshops develop participants’ problem-solving skills while providing them with a thorough understanding and appreciation of the foundational principles required for success in their career pursuits at Cornell.

Professional Networking Events

Each year the Diversity Programs in Engineering office sponsors networking events that allow company representatives from all over the United States to meet with students historically underrepresented in the field of engineering. Summer internships and permanent jobs frequently result from these annual events.

Master Your Future

This is a seminar series that highlights a variety of career topics, including networking, interviewing, job-search strategies, résumé writing, co-op/internship opportunities, preparation for graduate school, etc.

Employer Info Sessions

These information sessions, held by corporate representatives, are designed to expose students to careers and job opportunities within a particular industry.
Social/Coffee Hours
These are weekly morning and/or mid-day “food and friends” gatherings for students.

Lunch and Learn
This seminar session, with lunch provided, provides an opportunity for students to network with and learn from Cornell alums.

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 following programs are offered through Engineering Learning Initiatives: Academic Excellence Workshops (AEWs), Tutors-On-Call, Undergraduate Research, the Cornell LeaderShape®, Institute, and Engineering TA Training.

For more information on these programs, call 255.9622, send e-mail to eng-learning@cornell.edu, or visit www.engineering.cornell.edu/student-services/learning.

Academic Excellence Workshop (AEW)
Academic Excellence Workshops (AEWs) are 1-credit, small-group, cooperative-learning sessions that complement the core engineering courses, including MATH 1910, 1920, 2930, and 2940; CHEM 2090; and CS 1110, 1112, and 2110. The weekly two-hour workshops are led by trained peer facilitators and offer a cooperative environment where students work together on concepts, problems, and projects to enhance understanding of course material. AEWs are based on research showing that cooperative methods promote higher grades, greater persistence, deeper comprehension, more enjoyment in learning, and more positive attitudes toward academic work. To register for an AEW, access the online add/drop instructions through Just The Facts/Student Center under the ENGRG courses. For more information on AEW, visit www.engineering.cornell.edu/student-services/aew/.

Tutors-on-Call
The goal of the Tutors-on-Call program is to promote students’ development of critical-thinking and problem-solving skills through peer guidance and support. Peer tutors are available free of charge for many first- and second-year core courses for engineering students, including mathematics, chemistry, physics, computer science, and distribution courses. Peer tutors earn an hourly wage and are trained to help their peers master course content and improve learning skills. Tutors must have a 3.0 GPA and have earned an A or a B in the course(s) they tutor. Tutors can help students better understand key concepts, apply concepts to problems and projects, and review and prepare for examinations. One-on-one tutoring is intensive and gives each student individualized assistance. To request a tutor, complete the online Tutor Request Form at www.engineering.cornell.edu/student-services/learning/peer-tutoring/ or visit the Engineering Learning Initiatives office in 167 Olin Hall to submit a paper copy.
Cornell LeaderShape® Institute

The Cornell LeaderShape® Institute is a dynamic, interactive, six-day residential retreat, emphasizing vision planning and leadership development. The curriculum is provided by LeaderShape®, Inc., a not-for-profit organization that has been helping young adults learn to “lead with integrity” since 1988. It begins with participants engaging in self-reflection and learning about the power of visions and goals, and results in participants creating powerful visions for themselves and for their student organizations. Overall, student participants will explore personal characteristics; expand their understanding about leadership; meet and work with peers; and talk to current leaders of the college, university, and surrounding community. For more information, visit www.engineering.cornell.edu/student-services/learning/leadershape/.

Engineering TA Training

New teaching assistants (TAs) in the College of Engineering become certified by completing the TA Development Program, which includes training in classroom management, diversity, grading, cooperative learning, and presentation skills. While the majority of TAs are graduate students, some undergraduates have the opportunity to be trained and serve as teaching assistants in their fourth year. By giving TAs a sophisticated understanding of how human learning occurs, as well as rigorous training in course management responsibilities, we are creating a pool of talent that enriches the pedagogical life of the college. In addition, TAs may also receive credit for their successful participation in the 1-credit course, ENGRG 6780: Teaching Seminar. This course, offered by Engineering Learning Initiatives as an enhancement to the TA Development Program, aims to upgrade teachers’ skills, increase teaching standards, and improve student-learning outcomes through formative discussion and reflective writing.

Engineering Registrar

The Engineering Registrar’s office, located in 158 Olin Hall, is the main repository of all engineering student records. This office is distinct from the University Registrar’s office located in B7 Day Hall.

The Engineering Registrar’s office oversees course enrollment, grading, course scheduling, room assignments, and examination scheduling for the College of Engineering. It is responsible for maintaining the Student Information System, and processes all grade and course updates. Any official documents relating to academic matters are filed as part of each student’s permanent record and held there. It also produces reports regarding course, enrollment, and student data. Students who need an official transcript or certification of enrollment should go through the University Registrar’s office.
University Student Records Policy

The university regards a student’s enrollment status (e.g., registered, on leave, withdrawn, etc.) 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 such 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 by the university 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 must apply for affiliation with a Major during the first semester of their second year, although 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 course and grade requirements (see pages 34–36).

Occasionally, a student falls just short of meeting standard affiliation requirements but demonstrates potential in the Major. In such cases, a Major may offer “conditional affiliation.” Conditional affiliation involves a written agreement signed by both the Major and the student. Students must meet the requirements specified in the conditional affiliation agreement to continue in the Major.

Students who are not affiliated or conditionally affiliated with a Major by the end of the fourth semester will be withdrawn from the College of Engineering. Future enrollment in the College of Engineering is dependent on affiliation or participation in a terminal semester.

Major Descriptions, Flow Charts, and Check Lists

Each Major program is described in detail in Courses of Study. Flow charts on pages 39, 44, 50, 56, 61, 65, 70, 78, 83, 88, 92, and 96 in this handbook present the courses that make up these Majors. 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. The sequence of courses may also be influenced by advanced placement or transfer credit.

Requirements for graduation differ from Major to Major. In addition to completing the requirements of the Common Curriculum, students must take a range of courses that constitutes the Major; they must earn grades that are adequate to remain in good standing (see page 154 for specific Major requirements for good standing); and they must accumulate sufficient credits for graduation. Each of these three parameters differs by Major, and students are responsible for knowing and meeting the requirements of the Major with which they affiliate. Specific Major requirements are set forth later in this publication and in Courses of Study. Students should consult their undergraduate Major consultants (listed on pages 10–12) and their faculty advisors if they have questions regarding the requirements.

Requirements for Major Affiliation

Biological Engineering (BE)

Cumulative GPA ≥2.5 and at most one grade below C– in math, science, and engineering courses. Completion of ENGRD 2600 (or 2510) and Introductory Biology by end of the sophomore year with at least C– in each course (also applies to transfer students).
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.

Civil Engineering (CE)
GPA ≥2.0 for all engineering and science courses. At least C– in ENGRD 2020 (or ENGRD 2510 for students who do not take ENGRD 2020 before affiliation).

Computer Science (CS)
At least C in all completed CS and math courses. GPA ≥2.5 in CS 2110, 2111, and 2800. GPA ≥2.5 in MATH 1920 and CS 2800. Visit the CS undergraduate office website to learn about alternative criteria for affiliation.

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

Engineering Physics (EP)
At least B– in all required math and physics courses.

Environmental Engineering (EnvE)
GPA ≥2.0 for all engineering and science courses. At least C– in ENGRD 2510.

Independent Major (IM)
Cumulative GPA ≥2.0.

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

Materials Science and Engineering (MSE)
At least C– in math, physics, and chemistry courses and at least C in ENGRD 2610 or 2620.
Mechanical Engineering (ME)

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

Operations Research and Engineering (OR&E)

At least a grade of C in each of ENGRD 2700 and MATH 2940. GPA ≥ 2.0 in math, science, and engineering courses (both overall and in the term immediately before affiliation). A grade of at least C– in all completed ORIE courses. Good academic standing in the College of Engineering.

Science of Earth Systems (SES)

Good academic standing in the College of Engineering.
Major Programs

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)

Required Major Courses
BIOG 1101–1104: Biological Sciences
BIOBM 3300 or 3330: Principles of Biochemistry
or
BIOMI 2900: General Microbiology Lectures
or
CEE 4510: Microbiology for Environmental Engineering
BIO XXXX: Biological Science course(s) at ≥2000 level
CHEM 1570: Introduction to Organic and Biological Chemistry
or
CHEM 3570: Organic Chemistry for the Life Sciences
BEE 1510 or CS 1110, 1112, 1113, or 1114: Introduction to Computing
CS 1130: Transition to Object-Oriented Programming
or
CS 1132: Transition to MATLAB
ENGRG 1050: Engineering Seminar
or
BEE 1200: The BEE Experience
BEE 2600/ENGRD 2600: Principles of Biological Engineering
or
BEE 2510/ENGRD 2510: Engineering for a Sustainable Society
BEE 3500: Biological and Environmental Transport Processes
BEE 2220: Bioengineering Thermodynamics and Kinetics
or
ENGRD 2210: Thermodynamics
CEE 3040: Uncertainty Analysis in Engineering
or
ENGRD 2700: Basic Engineering Probability and Statistics
BEE 3310: Bio-Fluid Mechanics
or
CEE 3310: Fluid Mechanics

Concentration electives: Three courses from approved list.

Major-approved electives to complete remaining credits.

**Major-Approved Engineering Electives and Concentration Courses**

One course must be a BEE Capstone course and one must be a BEE Laboratory Experience course (see department web page for a current list of approved courses).

BE Concentrations: Biomedical Engineering, Bioprocess Engineering, or Bioenvironmental Engineering (see department web page for a current list of approved concentration courses).

The requirements for premedical study can be met with an additional 6–9 credits if courses are carefully selected.
Biological Engineering Major (BE)

a. Engineering electives must include BEE Capstone design and BEE lab experience.
b. ENGRD 2700 (fall, spring) or CEE 3040 (fall)
c. Students may substitute BIOG 1105–1106 or BIO 1109–1110.
d. Upper-level BIO S. need to take either Biochemistry or Microbiology—BIOBM 3300, or BIOBM 3330, or BIOBM 3310 and BIOBM 3320, or BIOMI 2900, or CEE 4510.
e. Required of CALS matriculants only. Engineering matriculants complete ENGRG 1050.
Biological Engineering Major Check List

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>√ When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1910</td>
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<td>Physical Education (two semesters) and swim test</td>
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</tbody>
</table>

Required Major Courses (46-credit minimum)

Introduction to Engineering (not required of CALS–matriculating BE students who complete BEE 1510 and BEE 1200)d | 3/0 ❑ |
Engineering Distribution 1: ENGRD 2020e | 4 ❑ |
Engineering Distribution 2: (BEE/ENGRD 2600 or BEE/ENGRD 2510) | 3 ❑ |
ENGRG 1050 or BEE 1200f | 0/1 ❑ |
BEE 3500 | 3 ❑ |
BEE 2220 or ENGRD 2210 | 3 ❑ |
CEE 3040 or ENGRD 2700e | 4/3 ❑ |
BEE 3310 or CEE 3310 | 4 ❑ |
Major Concentration Electiveg | 3 ❑ |
Major Concentration Electiveg | 3 ❑ |
Major Concentration Electiveg | 3 ❑ |
Major-approved Engineering Electivese | 12–17 ❑ |

Total Required Credits | 127 minimum ❑ |

Capstone Design Requirement ❑
Laboratory Experience Requirement ❑
Technical Writing Requirement ❑
Notes

a. May substitute BIOG 1105–1106 (4 cr each): Introductory Biology or
   BIOG 1109–1110 (3 cr each): Biological Principles. All BIO courses
   must be taken for letter grade.

b. 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.

c. The six courses must be chosen from at least three of the following
   six groups: (1) Cultural Analysis (CA); (2) Historical Analysis (HA);
   (3) Literature and the Arts (LA); (4) Knowledge, Cognition, and
   Moral Reasoning (KCM); (5) Social and Behavioral Analysis (SBA);
   and (6) Foreign Languages (not literature courses). At least two of
   the six courses must be at 2000-level or higher.

d. BE satisfies the intro-to-engineering course and credit requirement
   through a sequence of courses in the Major. An ENGRI course is not
   required of CALS matriculating students.

e. The 9 credits of Major-complementary courses are ENGRD 2020,
   CEE 3040, or ENGRD 2700, and a non–BEE engineering elective.

f. BE students matriculating in CALS take BEE 1200. Engineering
   students take ENGRG 1050 prior to affiliating with BE.

g. Major courses must include a BEE Capstone Design course and a
   BEE Laboratory Experience course. See department web page for a
   current list of approved courses.
Major: Chemical Engineering (ChemE)

Accredited by ABET (see inside front cover).
Offered by: School of Chemical and Biomolecular Engineering
120 Olin Hall, 255.8656, 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)

Required Major Courses

CHEM 2510: Introduction to Experimental Organic Chemistry
CHEM 2900: Introductory Physical Chemistry Laboratory
CHEM 3570: Organic Chemistry for the Life Sciences
CHEM 3900: Honors Physical Chemistry II
CHEME 3010: Nonresident Lectures
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


Four Major-approved electives (includes the advanced science elective$^c$ and the biology elective$^d$)
Chemical Engineering Major (ChemE)

- This is a major-approved elective.
- May be taken in semester 7 or 8.
- The biology requirement can be taken in semester 4 or later.

Note: This chart does not include Liberal Studies and Physical Education requirements.
### Chemical Engineering Major Check List

<table>
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<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>√ When Done</th>
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<td>PHYS 1112 (or 1116)</td>
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<td>CS 1130 (or 1132)</td>
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<td>Engineering Distribution 1: ENGRD 2190</td>
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<td>Engineering Distribution 2: CHEM 3890 (recommended)</td>
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<td>Physical Education (two semesters and swim test)</td>
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### Required Major Courses (52-credit minimum)\(^{h}\)

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<td>Advanced CHEME Elective 1(^{i})</td>
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<tr>
<td>Advanced CHEME Elective 2(^{i})</td>
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<td>√</td>
</tr>
</tbody>
</table>

### Courses outside the Major:

- CHEM 2510                                  | 2                    | √           |
- CHEM 2900                                  | 2                    | √           |
- CHEM 3570                                  | 3                    | √           |
- CHEM 3900                                  | 4                    | √           |

### Major-approved Elective

- Major-approved Elective 1: Biology Elective | 3 | √ |
- Major-approved Elective 2: Advanced Science Elective | 3 | √ |
- Major-approved Elective 3\(^{i}\)           | 3 | √ |
- Major-approved Elective 4\(^{i}\)           | 3 | √ |

| Total Required Credits                      | 128 minimum          |
Notes

a. CHEM 3890 is required by the Major, and it is recommended that this course be counted as an engineering distribution course.

b. Premed students need 8 credits of organic chemistry.

c. Advanced science electives include: AEP: any course >3330; BIOBM 3300, 3310, 3320, 3330; CHEME 4010, 4020, 4700, 4720, 4800, 4810, 4840, 5200–5209, 5430, 6310, 6400, 6610; CHEM: any course >3010 except 3890; CEE 4510, 6540; FDSC 4170; MSE 2060, 3050, 5210, 5240, 5310, 5410; MAE 4230; BIOMI 2900; PHYS: any course >3300; TAM 3100, 3110.

d. Every student must complete one of the six following options for the biology elective:
   • Advanced Placement—a score of 5 on the CEEB AP exam or a score of 7 on the IB Higher Level exam.
   • CHEME 2880: Biomolecular Engineering: Fundamentals and Applications (spring, 3 credits)
   • four credits of a pre-med biology sequence; BLOG 1101: Biological Sciences, Lectures (fall, 2 credits) and BLOG 1103: Biological Sciences, Laboratory (fall, 2 credits); BLOG 1102: Biological Sciences, Lectures (spring, 2 credits) and BLOG 1104: Biological Sciences, Laboratory (spring, 2 credits); BLOG 1105: Introductory Biology (fall, 4 credits); BLOG 1106: Introductory Biology (spring, 4 credits); BLOG 1107: General Biology (first half of the eight-week summer session, 4 credits); or BLOG 1108: General Biology (second half of the eight-week summer session, 4 credits).
   • three credits of microbiology—BIOMI 2900: General Microbiology Lectures (fall, spring, or six-week summer session, 3 credits).
   • four credits of biochemistry—BIOBM 3300: Principles of Biochemistry, Individual Instruction (fall or spring, 4 credits) or BIOBM 3330: Principles of Biochemistry: Proteins, Metabolism, and Molecular Biology (six-week summer session, 4 credits).
   • five credits of biochemistry—BIOBM 3310: Principles of Biochemistry: Proteins and Metabolism (fall, 3 credits) and BIOBM 3320: Principles of Biochemistry: Molecular Biology (spring, 2 credits).

e. If CHEM 3890 is taken as an engineering distribution, the fourth credit may apply as an approved elective credit.

f. 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 (CHEME 4320: Chemical Engineering Laboratory satisfies this requirement).
g. The six courses must be chosen from at least three of the following six groups: (1) Cultural Analysis (CA), (2) Historical Analysis (HA), (3) Literature and the Arts (LA), (4) Knowledge, Cognition, and Moral Reasoning (KCM), (5) Social and Behavioral Analysis (SBA), (6) Foreign Languages (not literature courses). At least two of the six courses must be at 2000-level or higher.

h. The required 9 credits of Major program courses outside the Major consist of courses in chemistry.

i. Students who want a biomolecular focus should use the following courses as electives: BIOBM 3300 as an applied science elective, CHEME 4010 and CHEME 4020 as advanced chemical engineering electives, and CHEME 5430 or CHEME 4810 as a Major-approved 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 go to wwwcheme.cornell.edu/undergraduate/curriculum/.
Major: Civil Engineering (CE)

Accredited by ABET (see inside front cover).
Offered by: School of Civil and Environmental Engineering
221 Hollister Hall, 607.255.3412, 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.

Students interested in the Environmental Engineering Concentration of the Civil Engineering Major should follow the requirements listed in this handbook for the Environmental Engineering Major and should refer to the CEE Undergraduate Handbook for requirements specific to CE Majors. The key requirements for the Environmental Engineering Concentration are that CE Majors should take CEE 3230: Engineering Economics and Management, CEE 3410: Introduction to Geotechnical Engineering for their Earth Science, CS 1110: Introduction to Computing Using Java or CS 1112: Introduction to Computing Using MATLAB, CS 1132: Transition to MATLAB or CS 1130: Transition to Object-Oriented Programming, and ENGRD 3200: Engineering Computation.

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 for a Sustainable Society (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 3200a: Engineering Computation (recommended for all students)
Required Major Courses
ENGRD 2030: Dynamics
or
CEE 4780\textsuperscript{b}: Structural Dynamics and Earthquake Engineering
ENGRD 3200\textsuperscript{a}: Engineering Computation
CEE 3040\textsuperscript{a,c}: Uncertainty Analysis in Engineering
CEE 3230: Engineering Economics and Management
CEE 3310: Fluid Mechanics
CEE 3410: Introduction to Geotechnical Engineering
CEE 3510\textsuperscript{d}: Environmental Quality Engineering
CEE 3610\textsuperscript{d}: Introduction to Transportation Engineering
CEE 3710: Structural Modeling and Behavior

Electives
Technical writing course (see listing of approved courses in Courses of Study)\textsuperscript{e}
Three CEE design courses\textsuperscript{f}
Two Major-approved electives\textsuperscript{f}
Two approved electives
Civil Engineering Major (CE)

a. Students taking ENGRD 2030, 3200, or CEE 3040 as a second engineering distribution must take an additional major-approved elective.

b. ENGRD 2700 may be accepted (by petition) to substitute for CEE 3040 if taken prior to affiliation in the major or if necessary because of scheduling conflicts caused by co-op or other study abroad programs.

c. Students may substitute CHEM 2080 or CHEM 1570 for PHYS 2214.

d. ENGRD 2030 may be taken in the second year; CEE 4780 should not be taken until the third or fourth year.

e. Students may take CEE 3510, 3610, or 3710 in semester 4, depending on their interests.

f. Students may substitute either CEE 3720 or CEE 4710 for either CEE 3510 or CEE 3610, if they also complete CEE 4730 or CEE 4740. However, CEE 3720 or CEE 4710 then counts as a Core Course only and not as a CE Design Course or Major-Approved Elective.

g. Students may substitute CEE 4610 for CEE 3510 if they also take two of the three courses: CEE 4630, CEE 4640, CEE 4650. However, then CEE 4610 counts as a Core Course only and cannot be counted as a Major-Approved Elective.

h. Recommended: ENGRD 2610 for Infrastructure; ENGRD 2210 for Hydraulics; ENGRD 2110 for Transportation; ENGRD 2510 for Environmental.

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

j. If the technical communication requirements are met with a course that fulfills another requirement, then an additional approved elective is required.

Note: This chart does not include Liberal Studies and Physical Education requirements.
## Civil Engineering Major Check List

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>√ When Done</th>
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<tr>
<td>MATH 1910</td>
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<td>MATH 1920</td>
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<td>Physical Education (two semesters) and swim test</td>
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<td>Required Major Courses (49-credit minimum)</td>
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<td>ENGRD 2030 or CEE 4780</td>
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<td>CEE 3310</td>
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<td>CEE 3610</td>
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<td>☑</td>
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<tr>
<td>Major-approved Elective 1</td>
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</tr>
<tr>
<td>Major-approved Elective 2</td>
<td>3</td>
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<tr>
<td>Total Required Credits</td>
<td>125 minimum</td>
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<tr>
<td>Additional Elective Courses (0 credits minimum, no maximum)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Note: √ indicates when done. 

**Major Programs:** Civil Engineering
Notes

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

b. ENGRD 2030 may be taken in the second year, but CEE 4780 should not be taken until the third or fourth year.

c. 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.

d. 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 CEE 3510 or CEE 3610, if they also complete either CEE 4730: Design of Concrete Structures or CEE 4740: Design of Steel Structures. However, CEE 3720 or CEE 4710 then counts as a Core Course only and not as a CEE Design Course or Major-approved elective. Students interested in pursuing a concentration in transportation systems may substitute CEE 4610: Urban Transportation Planning and Modeling for CEE 3510 if they also take two of these three courses: CEE 4630: Transportation and Information Technology, CEE 4640: Transportation Systems Design, and CEE 4650: Environment/Energy, and Transportation Planning and Management. However, CEE 4610 then counts as a Core Course only and cannot be counted as a Major-approved Elective.

e. If the technical communications requirement is met with a course that fulfills another requirement (liberal studies, Major-approved elective, etc.), then the student must take an additional approved elective.

f. To be chosen from lists available in the CE Major 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.

g. Recommended: ENGRD 2610 for civil infrastructure; ENGRD 2210 for hydraulics; ENGRD 2110 for transportation; ENGRD 2510 for environment; ENGRD 3200a for all students.

h. In addition to the first-year writing seminars, a technical writing course must be taken. An approved COMM course, any ENGRC course or BEE 4890: Entrepreneurial Management for Engineers will satisfy this requirement. If the course fulfilling the technical elective requirement also fulfills another requirement (liberal studies, Major-approved elective), an additional advisor-approved elective must be taken.
i. The six courses must be chosen from at least three of the following six groups: (1) Cultural Analysis (CA), (2) Historical Analysis (HA), (3) Literature and the Arts (LA), (4) Knowledge, Cognition, and Moral Reasoning (KCM), (5) Social and Behavioral Analysis (SBA), (6) Foreign Languages (not literature courses). At least two of the six courses must be at 2000-level or higher.

j. Nine credits of electives are determined by Major approval. To ensure breadth of engineering studies, Major programs also will include 9 credits of courses outside the Major. This group of courses may be comprised of ENGRD 2020, ENGRD 2030, one engineering distribution or elective, and/or a CE Major course outside the Major disciplinary area.
Major: Computer Science
Offered by: Department of Computer Science
303 Upson Hall, 255.0982, www.cs.cornell.edu/degreeprogs/ugrad/

Program Objectives
Emphasizing the underlying principles of the computing process and its applications in systems; computer vision; artificial intelligence; database design and management; information retrieval, language, and text processing; financial analysis; multimedia systems; supercomputing; computer graphics and scientific visualization, including advanced analysis and design.

Engineering Distributions
ENGRD 2110: Object-Oriented Programming and Data Structures (required)
ENGRD 2300: Introduction to Digital Logic Design (recommended for students interested in computer engineering)

Required Major Courses
CS 2111: Programming Practicum
CS 2800: Discrete Structures
CS 3110: Data Structures and Functional Programming
CS 3410: Systems Programming
or
CS 3420/ECE 3140: Computer Organization
ENGRD 3220: Introduction to Scientific Computation
or
CS 4210: Numerical Analysis and Differential Equations
or
CS 4220: Numerical Analysis: Linear and Nonlinear Equations
CS 3810: Introduction to Theory of Computing
CS 4410: Operating Systems
CS 4820: Introduction to Analysis of Algorithms

Electives
Two CS electives numbered ≥4000; 3-credit minimum per course; CS 4999 not allowed
One CS project course; 2-credit minimum
One mathematics-related elective course (≥3000 level) or a mathematically oriented course from a related technical area (e.g., ORIE, ECE, PHYS, TAM); 3-credit minimum
Two Major-approved technical electives numbered ≥3000; 3-credit minimum per course
Two advisor-approved, free electives

Three related, upper-level elective courses numbered ≥3000 (specialization); 3-credit minimum per course; CS courses not allowed
Computer Science Major (CS)

a. CS 1110, CS 1113, CS 1130, or equivalent course in Java is a prerequisite for moving on to 2110.

b. May substitute PHYS 2214 for CHEM 2080. MATH 2930 is a prerequisite for PHYS 2214.

Note: This schedule represents the latest possible entry into the Computer Science Major.

Typically, CS 1110 (or 1112, 1113, or 1114), 1130 (or 1132), 2110, 2111, 2800, 3110, and 3410 (or 3420) are completed by the end of the second year.

See accompanying description for explanation of upper-class course requirements.

Note: This chart does not include Liberal Studies, Physical Education, or elective requirements.
# Computer Science Major Check List

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>√ When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1910</td>
<td>4</td>
<td>☑</td>
</tr>
<tr>
<td>MATH 1920</td>
<td>4</td>
<td>☑</td>
</tr>
<tr>
<td>CS 2800</td>
<td>3</td>
<td>☑</td>
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<tr>
<td>MATH 2940</td>
<td>4</td>
<td>☑</td>
</tr>
<tr>
<td>CHEM 2090</td>
<td>4</td>
<td>☑</td>
</tr>
<tr>
<td>PHYS 1112 (or 1116)</td>
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<td>☑</td>
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<tr>
<td>PHYS 2213 (or 2217)</td>
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</tr>
<tr>
<td>CHEM 2080 (or PHYS 2214 or 2218)</td>
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<tr>
<td>CS 1110 (or 1112, 1113, or 1114)</td>
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</tr>
<tr>
<td>CS 1130 (or 1132)</td>
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<tr>
<td>Introduction to Engineering (ENGRI 1XXX)</td>
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<tr>
<td>Engineering Distribution 1: ENGRD 2110</td>
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<td>Engineering Distribution 2</td>
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<tr>
<td>First-Year Writing Seminar 1&lt;sup&gt;a&lt;/sup&gt;</td>
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</tr>
<tr>
<td>First-Year Writing Seminar 2</td>
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</tr>
<tr>
<td>Liberal Studies Distribution—six courses (18-credit minimum)&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
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<tr>
<td>Liberal Studies 1</td>
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<td>Liberal Studies 5</td>
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<td>Liberal Studies 6</td>
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</tr>
<tr>
<td>Approved Elective (two courses; 6-credit minimum)</td>
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<td>Approved Elective</td>
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<tr>
<td>Physical Education (two semesters) and swim test</td>
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## Required Major Courses (48-credit minimum)

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<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>√ When Done</th>
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<td>CS 3110</td>
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<td>ENGRD 3220 or CS 4210 or CS 4220</td>
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<td>Specialization Elective 3&lt;sup&gt;c&lt;/sup&gt;</td>
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<td>Mathematics-Related Electives&lt;sup&gt;d&lt;/sup&gt;</td>
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<td>Major-approved Technical Elective</td>
<td>3</td>
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</tr>
</tbody>
</table>

Total Required Credits 123 minimum

Additional Elective Courses (0 credits minimum, no maximum) ☑
Notes

a. 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. (ENGRD 2640: Computer-Instrumentation Design satisfies this requirement.)

b. The six courses must be chosen from at least three of the following six groups: (1) Cultural Analysis (CA), (2) Historical Analysis (HA), (3) Literature and the Arts (LA), (4) Knowledge, Cognition, and Moral Reasoning (KCM), (5) Social and Behavioral Analysis (SBA), (6) Foreign Languages (not literature courses). At least two of the six courses must be at 2000-level or higher.

c. The outside specialization consists of 9 or more credits at the ≥3000 level. No CS courses are allowed. The three courses must be related to each other (3-credit minimum per course).

d. The mathematics elective involves taking a ≥3000-level course that has rigorous mathematical content. (ENGRD 2700: Basic Engineering Probability and Statistics and MATH 2930: Differential Equations for Engineers are the only courses below the 3000 level that satisfy this requirement.)

This engineering check list is formatted to conform to the general specifications of the College of Engineering. We strongly recommend that you visit 303 Upson Hall for an official Computer Science Major check list. This information can also be obtained by visiting the Computer Science web site (www.cs.cornell.edu/degereprogs/ugrad/).
Major: Electrical and Computer Engineering

Accredited by ABET (see inside front cover).
Offered by: School of Electrical and Computer Engineering
223 Phillips Hall, 255.4309, 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 2110: Object-Oriented Programming and Data Structures (recommended for those interested in the Computer Engineering specialty area)

Required Major Courses

ECE/ENGRD 2100: Introduction to Circuits for Electrical and Computer Engineers
ECE 2200: Signals and Information
ECE 3030: Electromagnetic Fields and Waves
ECE 3100: Introduction to Probability and Random Signals
ECE 3140/CS 3420: Computer Organization or CS 3410: Systems Programming
ECE 3150: Introduction to Microelectronics
Major-approved Electives

Advanced ECE Electives: six lecture courses

Major-complementary electives (outside the Major)\(^3\): 9 credits minimum

The minimum number of Major credits is currently 53. Details are available on the ECE graduation check list available in 223 Phillips Hall.

Culminating Design Experience (CDE)

We are committed to providing our students with the most useful and relevant educational experience possible. The Culminating Design Experience (CDE) courses, of which two are required for graduation, include a significant and open-ended engineering design assignment with realistic constraints. Consideration of most of the following issues will be an integral part of a CDE course: an ability to design a component, system, or process to meet desired needs that includes most of the following: economics, the environment, sustainability, manufacturability, ethics, health and safety, society, and politics. An updated list of courses that meet the CDE requirement will be posted each semester on the bulletin board outside of 223 Phillips Hall. The CDE courses for the academic year 2008–2009 are ECE 4150: GPS: Theory and Design, ECE 4260: Applications of Signal Processing, ECE 4370: Fiber and Integrated Optics, ECE 4530: Analog Integrated Circuit Design, ECE 4750: Computer Architecture, and ECE 4760: Digital Systems Design Using Microcontrollers.

Projects

Independent projects such as ECE 3910, 3920, 4910, or 4920 count only in the Advisor-approved Electives category.

Approved group projects (e.g., Ambumedics, CUAIR, CUAUV, Robotics, FSAE, etc.) may count as Outside ECE Technical electives for up to 6 credits.
Electrical and Computer Engineering Major (ECE)

Note: This chart does not include Liberal Studies and Physical Education requirements.

Semester 1: CHEM 2090

Semester 2: PHYS 112

Semester 3: MATH 2930

Semester 4: MATH 2940

First-Year Writing Seminar

Advanced Programming

ECE/ENGRD 2300

ECE 2100

ECE 2200

Note: This chart does not include Liberal Studies and Physical Education requirements.
Electrical and Computer Engineering Major Check List

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1910</td>
<td>4</td>
<td>✓</td>
</tr>
<tr>
<td>MATH 1920</td>
<td>4</td>
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<td>MATH 2930</td>
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<td>✓</td>
</tr>
<tr>
<td>CHEM 2090 or 2150</td>
<td>4</td>
<td>✓</td>
</tr>
<tr>
<td>PHYS 1112 or 1116</td>
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<td>PHYS 2213 or 2217</td>
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<td>PHYS 2214 or 2218</td>
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<td>✓</td>
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<tr>
<td>CS 1110 (or 1112, 1113, or 1114)</td>
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</tr>
<tr>
<td>CS 1130 (or 1132)</td>
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<td>✓</td>
</tr>
<tr>
<td>Applications of Probability and Statistics</td>
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<td>✓</td>
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<tr>
<td>Intro to Engineering (ENGRI 1XXX)</td>
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<td>Engineering Distribution 1: ECE/ENGRD 2300 (required)</td>
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<tr>
<td>Engineering Distribution 2: ENGRD 2110 (recommended for Computer Engineering)</td>
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<td>First-Year Writing Seminar 1\textsuperscript{b}</td>
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</tr>
<tr>
<td>First-Year Writing Seminar 2\textsuperscript{b}</td>
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<td>Liberal Studies Distribution—six courses (18-credit minimum)\textsuperscript{c}</td>
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<td></td>
</tr>
<tr>
<td>Liberal Studies 1</td>
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<tr>
<td>Liberal Studies 2</td>
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<td>Liberal Studies 5</td>
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<td></td>
</tr>
<tr>
<td>Liberal Studies 6</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>College/Advisor–Approved Elective (two courses, 6-credit minimum)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Physical Education (two semesters) and swim test</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

Required Major Courses\textsuperscript{d} (53 credits) \textsuperscript{✓}

Additional Engineering Requirements \textsuperscript{✓}

Technical Writing Course\textsuperscript{c} \textsuperscript{✓}

Total Required Credits 130 minimum

\textsuperscript{a} Major Programs: Electrical and Computer Engineering

\textsuperscript{b} \textsuperscript{c} \textsuperscript{d}
Notes

a. This engineering check list is formatted to conform to the general specifications of the College of Engineering and accurately reflects the first- and second-year requirements.

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

c. The six courses must be chosen from at least three of the following six groups: (1) Cultural Analysis (CA), (2) Historical Analysis (HA), (3) Literature and the Arts (LA), (4) Knowledge, Cognition, and Moral Reasoning (KCM), (5) Social and Behavioral Analysis (SBA), (6) Foreign Languages (not literature courses). At least two of the six courses must be at 2000 level or higher.

d. We strongly recommend that you visit 223 Phillips Hall or the Electrical and Computer Engineering web site (www.ece.cornell.edu) for an official Electrical and Computer Engineering Major check list appropriate for the class of 2008 and later.
Major: Engineering Physics
Offered by: School of Applied and Engineering Physics
212 Clark Hall, 255.5198, www.aep.cornell.edu

Program Objectives
The objectives for the Major in Engineering Physics are to:

• Give our students an adequate education in mathematics and physics so that 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 (recommended)
ENGRI 1200: Introduction to Nanoscience and Nanoengineering or ENGRI 1100: Lasers and Photonics

Engineering Distributions (suggested)
ENGRD 2520: The Physics of Life
ENGRD 2640: Computer-Instrumentation Design
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 3210–3220: Mathematical Physics I and II
AEP 3330: Mechanics of Particles and Solid Bodies (counts as an engineering distribution course)
AEP 3550: Intermediate Electromagnetism
AEP 3560: Intermediate Electrodynamics
AEP 3610: Introductory Quantum Mechanics
AEP 3620: Intermediate Quantum Mechanics
AEP 3630: Electronic Circuits (Laboratory)
AEP 4230: Statistical Thermodynamics
AEP 4340: Continuum Physics (Laboratory)
PHYS 4410a: Advanced Experimental Physics (Laboratory)
Engineering Physics Major (EP)

a. May simultaneously satisfy Major and distribution requirements.

b. May be taken in either semester 1 or 2.

c. Recommended but not required; satisfies college technical writing requirement. May also be taken in semester 5.

d. ECE 2100 and ECE 2300 can be substituted for AEP 3630.

e. Two of the 4 credits of PHYS 4410 can be satisfied by successfully completing AEP 3300/PHYS 3330 or ASTRO 4410. The remaining 2 credits can be satisfied by taking PHYS 4400 for 2 credits provided that the experiments in PHYS 4400 do not overlap with those in AEP 3300/PHYS 3330 or ASTRO 4410 (see Notes for details).

Note: This chart does not include Liberal Studies and Physical Education requirements, and Advisor-Approved Electives.
## Engineering Physics Major Check List

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1910</td>
<td>4</td>
<td>☑</td>
</tr>
<tr>
<td>MATH 1920</td>
<td>4</td>
<td>☑</td>
</tr>
<tr>
<td>MATH 2930</td>
<td>4</td>
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<td>MATH 2940</td>
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<td>☑</td>
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<tr>
<td>CHEM 2090 (or 2070 or 2150)</td>
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</tr>
<tr>
<td>PHYS 1112 (or 1116)</td>
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<td>PHYS 2213 (or 2217)</td>
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<tr>
<td>Introduction to Engineering: ENGRI 1200 or ENGRI 1100 (recommended)</td>
<td>3</td>
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<tr>
<td>Engineering Distribution 1: ENGRD 2640 (recommended)</td>
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<tr>
<td>Engineering Distribution 2: AEP 3330 (recommended)</td>
<td>3</td>
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</tr>
<tr>
<td>First-Year Writing Seminar 1&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3</td>
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<td>3</td>
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<tr>
<td>Liberal Studies Distribution—six courses (18-credit minimum)&lt;sup&gt;d&lt;/sup&gt;</td>
<td>18</td>
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<td>Liberal Studies 1</td>
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<tr>
<td>Liberal Studies 6</td>
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<tr>
<td>Approved Elective (two courses; 6-credit minimum)</td>
<td></td>
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<tr>
<td>Approved Elective</td>
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<tr>
<td>Physical Education (two semesters) and swim test</td>
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</tr>
</tbody>
</table>

### Required Major Courses (58-credit minimum)

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEP 3210</td>
<td>4</td>
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</tr>
<tr>
<td>AEP 3220</td>
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<tr>
<td>AEP 3330</td>
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<tr>
<td>AEP 3550</td>
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<tr>
<td>AEP 3560</td>
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<td>AEP 3610</td>
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<tr>
<td>AEP 3620</td>
<td>4</td>
<td>☑</td>
</tr>
<tr>
<td>AEP 3630</td>
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<td>☑</td>
</tr>
<tr>
<td>AEP 4230</td>
<td>4</td>
<td>☑</td>
</tr>
<tr>
<td>AEP 4340</td>
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</tr>
<tr>
<td>PHYS 4410&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>☑</td>
</tr>
<tr>
<td>Major-approved Elective</td>
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</tr>
<tr>
<td>Major-approved Elective</td>
<td>3</td>
<td>☑</td>
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<td>☑</td>
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<tr>
<td>Major-approved Elective</td>
<td>3</td>
<td>☑</td>
</tr>
<tr>
<td>Major-approved Elective</td>
<td>3</td>
<td>☑</td>
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</tbody>
</table>

(Six (6) Major-approved electives, five (5) of which must be technical courses at or above the 3000 level) no S/U grades ☑

| Total Required Credits                          | 128 minimum |

Additional Elective Courses (0 credits minimum, no maximum) ☑

Technical Writing Course<sup>c</sup>: ENGRD 2640 (recommended) ☑
Notes

a. Two of the 4 credits of PHYS 4410 can be satisfied by successfully completing AEP 3300/PHYS 3330. The remaining 2 credits can be satisfied by taking PHYS 4400 for 2 credits provided that the experiments in PHYS 4400 do not overlap with those in AEP 3300/PHYS 3330. (A list of experiments that are not appropriate will be prepared by AEP faculty and made available in the AEP office.) If a student chooses this option, AEP 3300/PHYS 3330 may also count as a technical elective, provided the remaining three technical electives are 4 credits each.

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, approved elective or Major course. (ENGRD 2640 satisfies this requirement.)

d. The six courses must be chosen from at least three of the following six groups: (1) Cultural Analysis (CA), (2) Historical Analysis (HA), (3) Literature and the Arts (LA), (4) Knowledge, Cognition, and Moral Reasoning (KCM), (5) Social and Behavioral Analysis (SBA), (6) Foreign Languages (not literature courses). At least two of the six courses must be at 2000-level or higher.

e. Nine credits of Major-complementary courses must be outside the Major.
Major: Environmental Engineering

Offered jointly by:
Department of Biological and Environmental Engineering
207 Riley-Robb Hall, 607.255.2173, www.bee.cornell.edu

and

School of Civil and Environmental Engineering
221 Hollister Hall, 607.255.3412, www.cee.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 needed skills 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.

Students majoring in Environmental Engineering may double Major in “Civil Engineering” or “Biological Engineering” to ensure that they receive an ABET-accredited engineering degree. Civil Engineering offers a concentration in Environmental Engineering. Biological Engineering offers a concentration in Bioenvironmental Engineering.

Introduction to Engineering

BEE 1200: The BEE Experience (required for students matriculating in CALS)\(^a\)

or

ENGRI 1XXX [ENGRI 1130: Water Treatment Design is recommended]

Engineering Distributions

ENGRD 2510: Engineering for a Sustainable Society (required)


Required Major Courses

BLOG 1101/1103: Biological Sciences\(^b\)

or

BLOG 1102/1104: Biological Sciences\(^b\)

or

BLOG 1105: Introductory Biology\(^b\)

or
BIOG 1106: Introductory Biology
or
BIOG 1107: General Biology
or
BIOG 1108: General Biology
or
BIOG 1109: Biological Principles
or
BIOG 1110: Biological Principles

ENG RD 2020: Mechanics of Solids

ENG RD 3200: Engineering Computation
or
ENG RD 2210: Thermodynamics

CEE 3040: Uncertainty Analysis in Engineering,b,c
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,d

Lab Course: CEE 4530: Laboratory Research in Environmental Engineering (fall), BEE 4270: Water Sampling and Measurement (fall), BEE 4730: Watershed Engineering (fall), or CEE 4370: Experimental Methods in Fluid Dynamics (every other spring)

BEE 4750: Environmental Systems Analysis

**Electives**

Technical communications course (Approved Technical communication courses are listed in Courses of Study, College of Engineering section. BEE 4730 with BEE 4930 or BEE 4530 or BEE 4890 are on the approved list)e

Three design electives, 9 credit minimum (chosen from list of allowed courses)f

Two Major-approved Engineering electivesf

Two approved electives
Environmental Engineering Major (EnvE)

a. ENGRI 1130 is recommended or BEE 1200 together with BEE 1510 satisfies the Intro to Engineering requirement.

b. ENGRD 2020, ENGRD 2210, or 3200, and CEE 3040 are required courses that may be used as a second distribution course. Students electing to count any of these as a second distribution course must take an additional Major-Approved Elective.

c. ENGRD 2700 may be accepted (by petition) to substitute for CEE 3040 if taken prior to affiliation in the Major or if necessary because of scheduling conflicts caused by co-op or study abroad programs.

d. Students choose from BIOG 1101/1103 (fall), 1102/1104 (spring), 1105 (fall), 1106 (spring), 1107 (summer), 1108 (summer), 1109 (fall), or 1110 (spring).

e. Students may choose from CEE 4530 (fall), BEE 4270 (fall), BEE 4730 (fall), or CEE 4370 (every other spring).

f. Students may choose from CEE 3410 (spring), EAS 3030, CSS 3650 (spring), or BEE 3710 (spring).

Note: Students must also take a course that meets the technical communications requirement. Students meeting the technical communications requirement with a course that fulfills another requirement will have met both requirements. This chart does not include Physical Education requirements.
Environmental Engineering Major Check List

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1910</td>
<td>4</td>
<td></td>
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<tr>
<td>MATH 1920</td>
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<tr>
<td>MATH 2930</td>
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<tr>
<td>PHYS 1112</td>
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<tr>
<td>PHYS 2213 (or 2217)</td>
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<tr>
<td>CS 1110 (or 1112, 1113, or 1114)</td>
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<tr>
<td>CS 1130 (or 1132)</td>
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<tr>
<td>BIOG 110X (BIOG 1101/1103, 1102/1104, 1105, 1106, 1107, 1108, 1109, or 1110)</td>
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<tr>
<td>First-Year Writing Seminar 2h</td>
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<tr>
<td>Liberal Studies Distribution—six courses (18-credit minimum)</td>
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<tr>
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<tr>
<td>Physical Education (two semesters) and swim test</td>
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</table>

Required Major Courses (57-credit minimum)

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<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>When Done</th>
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</thead>
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<tr>
<td>Engineering Distribution 1: ENGRD 2510 (required)</td>
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<td>Engineering Distribution 2: ENGRD 2020</td>
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<td>ENGRD 3200 or 2210b</td>
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<td>CEE 3040b,c</td>
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<tr>
<td>CEE 3230 or BEE 4890</td>
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<tr>
<td>CEE 3310</td>
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<tr>
<td>CEE 3410, EAS 3030, CSS 3650, or BEE 3710</td>
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<tr>
<td>CEE 3510</td>
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<tr>
<td>CEE 4510d</td>
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<td>Laboratory Coursek</td>
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<td>BEE 4750</td>
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<td>Major-approved Elective 1f</td>
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<tr>
<td>Major-approved Elective 2f</td>
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<td>Engineering electives to meet 57 engineering credits</td>
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<td></td>
</tr>
<tr>
<td>Total Required Credits</td>
<td>126 minimum</td>
<td></td>
</tr>
</tbody>
</table>

Additional Elective Courses (0 credits minimum, no maximum) |                  |

Technical Writing Coursee,h |                  |           |

Major Programs: Environmental Engineering
Notes

a. BEE 1510: Introduction to Computer Programming combined with BEE 1200 (5 credits) satisfy 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 difference with engineering course work.

b. Students electing to use this course as a second engineering distribution must take an additional Major-approved elective. Note: BIOG 1109 is not an engineering distribution course.

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

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

e. If the course fulfilling the technical writing requirement also fulfills another requirement (e.g. liberal studies, Major-approved elective) then it may be used to satisfy both requirements.

f. The lists of suggested courses are given in the Undergraduate Handbook for Environmental Engineering and cover the areas of environmental engineering, hydraulics/hydrology, environmental systems engineering, geotechnical engineering, remote sensing, air pollution, and renewable energy systems. The handbook is available in the department offices.

g. ENGRI 1130 is recommended.

h. In addition to the first-year writing seminars, a technical writing course must be taken. An approved COMM or ENGRC course, or BEE 4930 taken with BEE 4730 will satisfy this requirement.) Students meeting technical communications requirement with a course that fulfills another requirement (e.g. Liberal Studies, Lab, Design) can use that course to satisfy both requirements.

i. Six courses must be chosen from at least three of the following six groups: (1) Cultural Analysis (CA), (2) Historical Analysis (HA), (3) Literature and the Arts (LA), (4) Knowledge, Cognition, and Moral Reasoning (KCM), (5) Social and Behavioral Analysis (SBA), (6) Foreign Languages (not literature courses). At least two of the six courses must be at 2000-level or higher.

j. Nine credits of electives are determined by Major approval. To ensure breadth of engineering studies, Major programs also will include 9 credits outside the Major. This group of courses may be comprised of ENGRD 2020, one engineering distribution or elective, and/or a CEE or BEE Major course outside the Major disciplinary area.
k. CEE 4530 (fall), BEE 4270 (fall), BEE 4730 (fall), or CEE 4370 (every other spring).

l. Students matriculated in CALS may take BEE 1510 followed by CS 1130 for the computing requirement.
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 courses (The set of Major-approved elective courses is the same for both specialization options, and contains all the courses listed in the six areas below. In addition, students may choose to take INFO 4900: Independent Reading and Research, as one of their Major-approved elective courses.)
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
ECON 3010: Microeconomics
or
ECON 3130: Intermediate Microeconomic Theory
ENGRC 3350: Communications for Engineering Managers
or
ILROB 1750: Behavior, Values, and Performance
or
INFO 2450: Psychology of Social Computing
INFO 2300: Intermediate Design and Programming for the Web
INFO 3300: Data-Driven Web Applications
ORIE 3300: Optimization I
ORIE 3500: Engineering Probability and Statistics II
ORIE 3800: Information Systems and Analysis

Information Science Option
Three courses from Information Systems (Area II below)
One course from Mathematical Modeling in Information Technology (Area III below)
Three elective courses: Students must choose either Human-Centered Systems (Area V) or Social Systems (Area VI) and take all elective courses from that area.

Management Science Option
The four courses in Mathematical Models in Management Science (Area I)
Three elective courses:
  • one from Information Systems (Area II)
  • two from the union of Mathematical Modeling in Information Technology (Area III) and Information Technology Management Solutions (Area IV)

Area I. Mathematical Models in Management Science
ORIE 3150: Financial and Managerial Accounting
ORIE 3510: Introductory Engineering Stochastic Processes I
ORIE 4580: Simulation Modeling and Analysis
ORIE 4800: Information Technology
Area II. Information Systems
CS 4320: Introduction to Database Systems
CS 4450: Computer Networks
CS 4620: Introduction to Computer Graphics
CS 4700: Foundations of Artificial Intelligence
CS 4740: Introduction to Natural Language Processing
CS 5150: Software Engineering
CS 5430: System Security
CS 5780: Empirical Methods in Machine Learning and Data Mining
INFO 4300: Information Retrieval
INFO 4302: Web Information Systems
INFO 5300: The Architecture of Large-Scale Information Systems

Area III. Mathematical Modeling in Information Technology
CS 4780: Machine Learning
ECE 5620: Fundamental Information Theory
INFO 3720: Explorations in Artificial Intelligence
ORIE 4330: Discrete Models
ORIE 4740: Statistical Data Mining I
ORIE 4850: Applications of Operations Research and Game Theory to Information Technology

Area IV. Information Technology Management Solutions
ORIE 4810: Delivering OR Solutions with Information Technology
ORIE 5126: Supply Chain Management

Area V. Human-Centered Systems
DEA 4700: Applied Ergonomic Methods
INFO 3450: Human–Computer Interaction Design
INFO 3650: Technology in Collaboration
INFO 4400: Advanced Human–Computer Interaction Design
INFO 4450: Seminar in Computer-Mediated Communication
INFO 4500: Language and Technology
PSYCH 3470: Psychology of Visual Communications
PSYCH 3800a: Social Cognition
PSYCH 4130: Information Processing: Conscious and Nonconscious
PSYCH 4160a: Modeling Perception and Cognition

Area VI. Social Systems

AEM 3220b: Internet Strategy

ECON 3680b: Game Theory

ECON 4190: Economic Decisions Under Uncertainty

HADM 4489: The Law of the Internet and e-Commerce

INFO 3200: New Media and Society

INFO 3490: Media Technologies

INFO 3551: Computers: From the 17th Century to the Dotcom Boom

INFO 3561: Computing Cultures

INFO 3660: History and Theory of Digital Art

INFO 3871: The Automatic Lifestyle: Consumer Culture and Technology

INFO 4144: Responsive Environments

INFO 4290: Copyright in the Digital Age

INFO 4350: Seminar on Applications of Information Science

INFO 4470: Social and Economic Data

INFO 4850: Computational Methods for Complex Networks

INFO 5150: Culture, Law, and Politics of the Internet

ORIE 4350b: Introduction to Game Theory

SOC 3040: Social Networks and Social Processes

STS 4111: Knowledge, Technology, and Property
Information Science, Systems, and Technology Major (ISST)

a. The following courses may be substituted for PHYS 2214 if not used to fulfill other requirements: CHEM 2080, CHEM 2160, PHYS 2218, MATH 2930, MATH 3040, or CS 2800. Students who prefer to take PHYS 2214 must take MATH 2930 in semester 3 as a prerequisite.

b. ENGRD 3350 fulfills the technical writing requirement.

Note: This chart does not include Liberal Studies and Physical Education requirements.
Information Science, Systems, and Technology Check List

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>√ When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1910</td>
<td>4</td>
<td></td>
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<tr>
<td>MATH 1920</td>
<td>4</td>
<td></td>
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<tr>
<td>MATH 2940</td>
<td>4</td>
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<tr>
<td>MATH 2930 or 3040 or CS 2800</td>
<td>3 or 4</td>
<td></td>
</tr>
<tr>
<td>CHEM 2090 or 2150</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>PHYS 1112 (or 1116)</td>
<td>4</td>
<td></td>
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<tr>
<td>PHYS 2213 (or 2217)</td>
<td>4</td>
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<tr>
<td>PHYS 2214 (or 2218 or CHEM 2080 or 2160)✓</td>
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</tr>
<tr>
<td>CS 1110 (or 1112, 1113, or 1114) and CS 1130 (or 1132)</td>
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<tr>
<td>Introduction to Engineering: (ENGRI 1XXX)</td>
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<tr>
<td>First-Year Writing Seminar 1e</td>
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<td>First-Year Writing Seminar 2</td>
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<tr>
<td>Liberal Studies Distributionf—six courses (18-credit minimum)</td>
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<td>Liberal Studies 1</td>
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<td>Liberal Studies 6</td>
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<tr>
<td>Advisor Approved Elective (two courses; 6-credit minimum)</td>
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<tr>
<td>Physical Education (two semesters) and swim test</td>
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</tbody>
</table>

Required Major Courses (52-credit minimum)

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>√ When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIE 3300</td>
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<tr>
<td>ORIE 3500</td>
<td>4</td>
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<tr>
<td>INFO 2300</td>
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<tr>
<td>ORIE 3800</td>
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<tr>
<td>INFO 3300</td>
<td>3</td>
<td></td>
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<tr>
<td>ECON 3010 or ECON 3130</td>
<td>3</td>
<td></td>
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<tr>
<td>INFO 2450 or ILROB 1750 or ENGRC 3350</td>
<td>3</td>
<td></td>
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</table>

Information Science/Management Science Option (nine course, 27-credit minimum)

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>√ When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialization Elective</td>
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<td></td>
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<tr>
<td>Specialization Elective</td>
<td>3/4</td>
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<tr>
<td>Specialization Elective</td>
<td>3/4</td>
<td></td>
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<tr>
<td>Specialization Elective</td>
<td>3/4</td>
<td></td>
</tr>
<tr>
<td>Specialization Elective</td>
<td>3/4</td>
<td></td>
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<tr>
<td>Specialization Elective</td>
<td>3/4</td>
<td></td>
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<tr>
<td>Specialization Elective</td>
<td>3/4</td>
<td></td>
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<tr>
<td>Major-approved Elective</td>
<td>3/4</td>
<td></td>
</tr>
</tbody>
</table>

Total Required Credits 128 minimum
Notes

a. Students who take PSYCH 3420 or 4160 may also count their prerequisite, PSYCH 2050: Perception or PSYCH 2140: Cognitive Psychology, toward the Human-Centered Systems requirement. Students who take PSYCH 3800 may also count PSYCH 2800: Introduction to Social Psychology toward the Human-Centered Systems requirement. At most one of these 2000-level prerequisites can be counted.

b. Only one of ORIE 4350 and ECON 3680 can be taken for ISST credit. Only one of AEM 3220 and HADM 4474 can be taken for ISST credit. (HADM 4474 is not offered every year. Check with the School of Hotel Administration to determine when course is scheduled to be offered.)

c. 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.

d. CS 2110 is required by the Major and it is recommended that this course be counted as an engineering distribution course.

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. ENGRC 3350 is recommended as a technical writing course for ISST Majors.

f. The six courses must be chosen from at least three of the following six groups: (1) Cultural Analysis (CA), (2) Historical Analysis (HA), (3) Literature and the Arts (LA), (4) Knowledge, Cognition, and Moral Reasoning (KCM), (5) Social and Behavioral Analysis (SBA), (6) Foreign Languages (not literature courses). At least two of the six courses must be at 200-level or higher.

g. Nine credits of Major-complementary courses are required to be outside of the INFO rubric. These include one of ECON 3010 or 3130; one of INFO 2450, ILROB 1750, or ENGRC 3350; and one additional course that is not an INFO course and is listed in the ISST degree requirements web page (www.infosci.cornell.edu/ugrad/ISSTRequirements.htm).

This engineering check list is formatted to conform to the general specifications of the College of Engineering. We strongly recommend that you visit 303 Upson 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/ugrad/).
Major: Materials Science and Engineering

Accredited by ABET (see inside front cover).
Offered by: Department of Materials Science and Engineering
214 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 2190: Mass and Energy Balances
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 to affiliate)
MSE 2620: Electronic Materials for the Information Age (unless used to affiliate)
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
MSE 3110–3120: Junior Laboratory I and II
MSE 4020: Mechanical Properties of Materials, Processing, and Design
MSE 4030–4040: Senior Materials Laboratory I and II
MSE 4070: Materials Design Concepts II

**Electives**

Two materials-related electives covering two groups of different materials. 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.

One additional technical elective must be taken from outside MSE.
Materials Science and Engineering Major (MSE)

a. ENGRD 2610 or ENGRD 2620 satisfies the Major entry requirement.
b. May be taken in semester 1 or 2.

Note: This chart does not include Liberal Studies and Physical Education requirements.
# Materials Science and Engineering Major Check List

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1910</td>
<td>4</td>
<td>❑</td>
</tr>
<tr>
<td>MATH 1920</td>
<td>4</td>
<td>❑</td>
</tr>
<tr>
<td>MATH 2930</td>
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<tr>
<td>MATH 2940</td>
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<tr>
<td>CHEM 2090 (or 2150)</td>
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<tr>
<td>PHYS 1112 (or 1116)</td>
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<td>❑</td>
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<tr>
<td>PHYS 2213 (or 2217)</td>
<td>4</td>
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<tr>
<td>PHYS 2214 (or 2218)</td>
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<td>CS 1110 (or 1112, 1113, or 1114)</td>
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<td>Introduction to Engineering: (ENGRI 1XXX)</td>
<td>3</td>
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<tr>
<td>Engineering Distribution 1: ENGRD 2610 or 2620</td>
<td>3</td>
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<tr>
<td>Engineering Distribution 2: ENGRD 2XXXc</td>
<td>3</td>
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<td>First Year Writing Seminar 1&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>First Year Writing Seminar 2</td>
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<td>Liberal Studies Distribution—six courses (18-credit minimum)&lt;sup&gt;f&lt;/sup&gt;</td>
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<tr>
<td>Liberal Studies 1</td>
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<td>Approved Elective (two courses; 6-credit minimum)</td>
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<tr>
<td>Physical Education (two semesters) and swim test</td>
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<td>Required Major Courses (53-credit minimum)</td>
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<tr>
<td>MSE 2610 or MSE 2620</td>
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<td>MSE 3070</td>
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<td>MSE 3120</td>
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<td>MSE 4020</td>
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<td>MSE 4070</td>
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<td>Materials-related elective I</td>
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<td>Materials-related elective II</td>
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<td>Applications-related MSE-numbered elective I</td>
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<tr>
<td>Applications-related non–MSE-numbered elective II</td>
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<td>❑</td>
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<tr>
<td>Applications-related non–MSE-numbered elective III&lt;sup&gt;g&lt;/sup&gt;</td>
<td>3</td>
<td>❑</td>
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<tr>
<td>Outside non–MSE-numbered Technical Elective III&lt;sup&gt;g&lt;/sup&gt;</td>
<td>3</td>
<td>❑</td>
</tr>
<tr>
<td><strong>Total Required Credits</strong></td>
<td>132 minimum</td>
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<tr>
<td>Additional Elective Courses (0 credits minimum, no maximum)</td>
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<td>❑</td>
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<tr>
<td>Technical Writing Requirement&lt;sup&gt;f&lt;/sup&gt;</td>
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</tbody>
</table>

<sup>a</sup> Introduction to Engineering: ENGRI 1XXX
<sup>b</sup> First Year Writing Seminar 1
<sup>c</sup> Liberal Studies Distribution—six courses (18-credit minimum)
<sup>d</sup> Approved Elective (two courses; 6-credit minimum)
<sup>e</sup> Physical Education (two semesters) and swim test
<sup>f</sup> Required Major Courses (53-credit minimum)
<sup>g</sup> Outside non–MSE-numbered Technical Elective III
Notes

a. 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. The combination of MSE 3070/4070 with MSE 4030/4040 or MSE 4050/4060 satisfies this requirement.

b. Research-oriented students may replace MSE 4030 and 4040 (senior lab) with MSE 4050 and 4060 (senior thesis).

c. In addition to other 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, approved elective, materials application–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 list of example courses meeting this requirement is available in the MSE office, or online at www.mse.cornell.edu.

d. A list of approved materials-related and materials application–related courses is available in the MSE office or online at www.mse.cornell.edu.

e. The outside technical elective must be an upper level (2000 or above) technical course and may be selected from engineering or other colleges subject to advisor approval.

f. The six courses must be chosen from at least three of the following six groups: (1) Cultural Analysis (CA), (2) Historical Analysis (HA), (3) Literature and the Arts (LA), (4) Knowledge, Cognition, and Moral Reasoning (KCM), (5) Social and Behavioral Analysis (SBA), (6) Foreign Languages (not literature courses). At least two of the six courses must be at 2000-level or higher.

g. Nine credits of elective courses must be taken from outside MSE. These are satisfied by the outside technical elective and by 6 credits of the Major materials application–related electives.
Major: Mechanical Engineering

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: Mechanics of Solids (required)
ENGRD 2210: Thermodynamics (recommended)

Required Major Courses
ENGRD 2210: Thermodynamics
ENGRD 2030: Dynamics
MAE 2120: Mechanical Properties and Selection of Engineering Materials
MAE 2250: Mechanical Synthesis
MAE 3230: Introductory Fluid Mechanics
MAE 3240: Heat Transfer
MAE 3250: Analysis of Mechanical and Aerospace Structures
MAE 3260: System Dynamics
MAE 3272: Mechanical Property and Performance Laboratory
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
MAE 4291: Supervised Senior Design Experience
MAE 4300: Professional Practice in Mechanical Engineering

Major-approved Electives

Senior Design elective\(^a\)

Mathematics elective: TAM 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

Technical elective\(^b\)

Major concentration electives (two courses)\(^c\)

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).

For a complete list of designated senior design courses and concentration courses and for advisor approved electives and technical elective guidelines, consult: mae.cornell.edu.
Mechanical Engineering Major (ME)

a. Assuming no advanced placement, this course must be taken in the term indicated.
b. Most beneficial if taken before (or concurrently with) MAE 3260.
c. This course must be taken in the term indicated.
d. MAE 3780 is recommended. ENGRD 2100 or PHYS 3360 is also acceptable.

Note: Courses without prerequisites may be rearranged. This chart does not include Liberal Studies and Physical Education requirements.
# Mechanical Engineering Major Check List

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>√ When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1910</td>
<td>4</td>
<td>✓</td>
</tr>
<tr>
<td>MATH 1920</td>
<td>4</td>
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<td>MATH 2930</td>
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<td>MATH 2940</td>
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<td>CHEM 2090 or 2150</td>
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<tr>
<td>Introduction to Engineering: (ENGRI 1XXX)</td>
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<tr>
<td>Engineering Distribution 2: ENGRD 2210 (recommended)</td>
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<td>First Year Writing Seminar 1e</td>
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<tr>
<td>First Year Writing Seminar 2</td>
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<tr>
<td>Liberal Studies Distribution—six courses (18-credit minimum)</td>
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<tr>
<td>Liberal Studies 1</td>
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<td>Liberal Studies 2</td>
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<td>Advisor Approved Elective (two courses; 6-credit minimum)</td>
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<tr>
<td>Advisor Approved Elective</td>
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<tr>
<td>Physical Education (two semesters) and swim test</td>
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## Required Major Courses (52-credit minimum)

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>√ When Done</th>
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<tbody>
<tr>
<td>ENGRD 2030</td>
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<td>MAE 3780 (or ENGRD 2100 or PHYS 3360)</td>
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<td>MAE 2120</td>
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<td>MAE 2250</td>
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<td>MAE 3230</td>
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<td>Major-approved Electives</td>
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<td>Senior Design Elective</td>
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<td>Technical Elective</td>
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<tr>
<td>Concentration Elective</td>
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</tr>
</tbody>
</table>

Total Required Credits 127 minimum

Additional Elective Courses (0 credits minimum, no maximum) ✓

Technical Writing Course\(^{e}\): MAE 4272 ✓
a. Taken during the fourth year.

b. Generally any course at a level beyond the required courses of the college curriculum in engineering, mathematics, or science (chemical, physical, or biological). Business or organization courses excluded, except MAE 4610: Entrepreneurship for Engineers.

c. A Concentration comprises two designated MAE courses in one of the following areas: aerospace engineering, biomechanics, energy systems, engineering materials, mechanical systems and design, thermo-fluids engineering, and vehicle engineering.

d. May simultaneously satisfy Major and distribution requirements. In this case, students may satisfy total required credits in a variety of ways following affiliation.

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 (MAE 4272 satisfies this requirement).

f. The six courses must be chosen from at least three of the following six groups: (1) Cultural Analysis (CA), (2) Historical Analysis (HA), (3) Literature and the Arts (LA), (4) Knowledge, Cognition, and Moral Reasoning (KCM), (5) Social and Behavioral Analysis (SBA), (6) Foreign Languages (not literature courses). At least two of the six courses must be at 2000-level or higher.

g. The 9 credits of Major-complementary courses (outside the Major) are ENGRD 2020, ENGRD 2030, and TAM 3100 or ENGRD 2700 or CEE 3040 or ENGRD 3200.

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 Mechanical Engineering academic program information or visit 108 Upson Hall for additional information.
Major: Operations Research and Engineering
Offered by: School of Operations Research and Information Engineering
206 Rhodes Hall, 255.4856, www.orie.cornell.edu

Engineering Distributions
ENGRD 2110a: Objected-Oriented Programming and Data Structures
ENGRD 2700: Basic Engineering Probability and Statistics (required)

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 (OR&E)

a. May be taken in semester 3 or 4.

b. 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.

c. OR&E affiliates may take MATH 2930, CS 2800, or MATH 3040 to satisfy the fourth mathematics requirement. However, MATH 2930 is a prerequisite for PHYS 2214.

d. The following courses may be substituted for PHYS 2214: CHEM 2080, MATH 2930 (if not used to meet the mathematics requirement), CS 2800 (if not used to meet the mathematics requirement), MATH 3110, or MATH 3360. Students who prefer PHYS 2214 must take MATH 2930 in semester 3.

e. May be taken in semester 1 or 2.

Note: This chart does not include Liberal Studies and Physical Education requirements.
### Operations Research and Engineering Major Check List

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>√ When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1910</td>
<td>4</td>
<td>❑</td>
</tr>
<tr>
<td>MATH 1920</td>
<td>4</td>
<td>❑</td>
</tr>
<tr>
<td>MATH 2930&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4</td>
<td>❑</td>
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<tr>
<td>MATH 2940</td>
<td>4</td>
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<tr>
<td>CHEM 2090</td>
<td>4</td>
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</tr>
<tr>
<td>PHYS 1112 (or 1116)</td>
<td>4</td>
<td>❑</td>
</tr>
<tr>
<td>PHYS 2213 (or 2217)</td>
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<td>❑</td>
</tr>
<tr>
<td>PHYS 2214&lt;sup&gt;d&lt;/sup&gt;</td>
<td>4</td>
<td>❑</td>
</tr>
<tr>
<td>CS 1110 (or 1112, 1113, or 1114)</td>
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</tr>
<tr>
<td>CS 1130 (or CS 1132)</td>
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<td>❑</td>
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<tr>
<td>Introduction to Engineering: (ENGRI 1XXX)</td>
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<tr>
<td>Engineering Distribution 1: ENGRD 2700</td>
<td>3</td>
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<tr>
<td>Engineering Distribution 2: ENGRD 2110&lt;sup&gt;a&lt;/sup&gt; (recommended)</td>
<td>3</td>
<td>❑</td>
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<tr>
<td>First-Year Writing Seminar 1&lt;sup&gt;e&lt;/sup&gt;</td>
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<tr>
<td>First-Year Writing Seminar 2</td>
<td>3</td>
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</tr>
<tr>
<td>Liberal Studies Distribution—six courses (18-credit minimum)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>18</td>
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<tr>
<td>Liberal Studies 1</td>
<td></td>
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<td>Liberal Studies 4</td>
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<td>Liberal Studies 5</td>
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<tr>
<td>Liberal Studies 6</td>
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<tr>
<td>Advisor-approved Elective (two courses; 6-credit minimum)</td>
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<tr>
<td>Advisor-approved Elective</td>
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<tr>
<td>Physical Education (two semesters) and swim test</td>
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</tr>
</tbody>
</table>

### Required Major Courses (49-credit minimum)<sup>g</sup>

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>√ When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIE 3120</td>
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<tr>
<td>ORIE 3150</td>
<td>4</td>
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<tr>
<td>ORIE 3300</td>
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<td>ORIE 3310</td>
<td>4</td>
<td>❑</td>
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<tr>
<td>ORIE 3500</td>
<td>4</td>
<td>❑</td>
</tr>
<tr>
<td>ORIE 3510</td>
<td>4</td>
<td>❑</td>
</tr>
<tr>
<td>ORIE 4580</td>
<td>4</td>
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<tr>
<td>Behavioral Science (organizational behavior)</td>
<td>3</td>
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<tr>
<td>ORIE Elective</td>
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<td>❑</td>
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<td>ORIE Elective</td>
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<td>❑</td>
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<tr>
<td>ORIE Elective</td>
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<td>❑</td>
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<tr>
<td>Major-approved Electives—Non–ORIE</td>
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</tr>
<tr>
<td>Major-approved Elective</td>
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<td>❑</td>
</tr>
<tr>
<td>Major-approved Elective</td>
<td>3</td>
<td>❑</td>
</tr>
</tbody>
</table>

Total Required Credits 125 minimum

Additional Elective Courses (0 credits minimum, no maximum)  ❑
a. ENGRD 2110 is required by the Major. It is recommended that this course be counted as an engineering distribution.

b. All ENGRD courses may count as Major-approved electives. A complete list of Major-approved electives can be obtained in 203 Rhodes Hall.

c. OR&E 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). Either 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 OR&E. The following considerations should be borne in mind:

(i.) MATH 2930 is essential for advanced study in financial engineering. Also, MATH 2930 is a pre-requisite for PHYS 2214: Physics III: Optics, Waves, and Particles.

(ii) 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.

(iii) MATH 3040 covers fundamentals of formal proof techniques; this material is strongly recommended for students who intend advanced (Ph.D.–level) study in Operations Research or a related field.

d. 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.

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

f. The six courses must be chosen from at least three of the following six groups: (1) Cultural Analysis (CA), (2) Historical Analysis (HA), (3) Literature and the Arts (LA), (4) Knowledge, Cognition, and Moral Reasoning (KCM), (5) Social and Behavioral Analysis (SBA), (6) Foreign Languages (not literature courses). At least two of the six courses must be at 2000-level or higher.

g. The required 9 credits of Major-complementary courses (outside the Major) are ENGRD 2110, the behavioral science, and one Major-approved elective course.

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

Introduction to Engineering Courses
ENGRI 1220: Earthquake! (recommended)

Common Curriculum
CHEM 2090: Engineering General Chemistry and then CHEM 2080: General Chemistry\textsuperscript{a}
or
CHEM 2090: Engineering General Chemistry and CHEM 1570: Introduction to Organic and Biological Chemistry\textsuperscript{a}

Engineering Distributions
ENGRD 2XXX
ENGRD 2XXX

Required Major Courses
BIOG 1109–1110: Biological Principles (or BLOG 1101/1103–1102/1104): Biological Sciences\textsuperscript{a}
EAS 2200: The Earth System

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

Field/Observation/Laboratory Course (at least 3 credits):
See Courses of Study.

Specialization Courses
Four specialization courses are selected with the advisor’s approval, all within one of four defined areas of specialization. The areas of specialization include geology (including geochemistry or geophysics), biogeochemistry, ocean sciences, or atmospheric sciences. Other areas of specialization within earth sciences are possible but must be approved by the SES Committee. The specialization courses are intermediate to advanced level (3000 level or above) that build upon the base of the Common Curriculum and core courses. Two of the specialization courses count as Major-required courses and two of the specialization courses count as Major-approved electives.
Science of Earth Systems Major (SES)

a. Major requirement based on SES specialization.
b. If CHEM 2070–2080 is selected, CHEM 2570 can replace a second semester of biology.
c. Recommended: ENGR 1220.

Note: This chart does not include Liberal Studies and Physical Education requirements.
## Science of Earth Systems Major Check List

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
<th>√ When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1910</td>
<td>4</td>
<td>❑</td>
</tr>
<tr>
<td>MATH 1920</td>
<td>4</td>
<td>❑</td>
</tr>
<tr>
<td>MATH 2930</td>
<td>4</td>
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</tr>
<tr>
<td>MATH 2940</td>
<td>4</td>
<td>❑</td>
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<tr>
<td>CHEM 2090⁹ (or 2150)</td>
<td>4</td>
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<tr>
<td>CHEM 2080⁹ or 1570</td>
<td>4/3</td>
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</tr>
<tr>
<td>PHYS 1112</td>
<td>4</td>
<td>❑</td>
</tr>
<tr>
<td>PHYS 2213</td>
<td>4</td>
<td>❑</td>
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<tr>
<td>CS 1110 (or 1112, 1113, or 1114)</td>
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<td>CS 1130 (or CS 1132)</td>
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<td>ENGRI 1XXX</td>
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<tr>
<td>ENGRD 2XXX</td>
<td>3</td>
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<tr>
<td>First-Year Writing Seminar 1&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td>First-Year Writing Seminar 2</td>
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</tr>
<tr>
<td>Liberal Studies Distribution—six courses (18-credit minimum)&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td></td>
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<td>Liberal Studies 1</td>
<td>3</td>
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<td>Liberal Studies 2</td>
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<td>Liberal Studies 6</td>
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<tr>
<td>Approved Elective (two courses; 6-credit minimum)</td>
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<tr>
<td>Approved Elective</td>
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<td>❑</td>
</tr>
<tr>
<td>Physical Education (two semesters) and swim test</td>
<td></td>
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</tr>
</tbody>
</table>

### Required Major Courses (48-credit minimum)<sup>d</sup>

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
<th>√ When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAS 2200</td>
<td>4</td>
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</tr>
<tr>
<td>BIOG 1101/1103 or 1109</td>
<td>4/3</td>
<td>❑</td>
</tr>
<tr>
<td>BIOG 1102/1104 or 1100 or CHEM 2570&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4/3</td>
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<tr>
<td>EAS 3XXX core</td>
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<td></td>
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<tr>
<td>EAS 3XXX core</td>
<td>4/3</td>
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</tr>
<tr>
<td>EAS 3XXX core</td>
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<tr>
<td>Field Observation Course</td>
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<td>❑</td>
</tr>
<tr>
<td>EAS Specialization (Major required)</td>
<td>3/4</td>
<td>❑</td>
</tr>
<tr>
<td>EAS Specialization (Major-required)</td>
<td>3/4</td>
<td>❑</td>
</tr>
<tr>
<td>EAS Specialization (Major-approved elective)</td>
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<td>EAS Specialization (Major-approved elective)</td>
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<tr>
<td>Major-approved elective (3XXX or higher)</td>
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<td>Outside Major Elective</td>
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</tr>
<tr>
<td>Outside Major Elective</td>
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<td>❑</td>
</tr>
<tr>
<td>Outside Major Elective</td>
<td>3/4</td>
<td>❑</td>
</tr>
</tbody>
</table>

**Total Required Credits<sup>d</sup>** 123 minimum

### Technical Writing Course<sup>b</sup>
a. Either CHEM 2090–2080, or CHEM 2090–1570 should be selected. If CHEM 2090–2080 is selected, then CHEM 1570 can replace a semester of biology.

b. 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.

c. The six courses must be chosen from at least three of the following six groups: (1) Cultural Analysis (CA), (2) Historical Analysis (HA), (3) Literature and the Arts (LA), (4) Knowledge, Cognition, and Moral Reasoning (KCM), (5) Social and Behavioral Analysis (SBA), (6) Foreign Languages must be selected so that the Major required total is at least 48 credits and the overall total is at least 123 credits.

d. Enough 4 credit courses among those listed as either 3 or 4 credits must be selected so that the Major required total is at least 48 credits and the overall total is at least 123 credits.
Engineering Minors

The Engineering Minor, a supplement to the bachelor’s degree Majors in the college, including the Independent Major, recognizes formal study of a particular technical subject area in engineering outside the student’s Major.

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, approved electives), the Minor may sometimes be completed within the traditional eight semesters. However, more than eight semesters may be needed.

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 advisor.

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 other than that which offers the student’s Major.

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

Students may apply for certification of an Engineering Minor at any time after the course work has been completed in accordance with published standards. Students who receive certification in an approved Engineering Minor will be recognized by means of an official notation on their Cornell transcript, following graduation.

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

Aerospace Engineering (MAE)
Applied Mathematics (TAM)
Biological Engineering (BEE)
Biomedical Engineering (BME)
Civil Infrastructure (CEE)
Computer Science (CS)
Electrical and Computer Engineering (ECE)
Engineering Management (CEE)
Engineering Statistics (ORIE)
Environmental Engineering (BEE/CEE)
Game Design (CS)
Industrial Systems and Information Science Technology (ORIE)
Information Science (CS)
Materials Science and Engineering (MSE)
Mechanical Engineering (MAE)
Operations Research and Management Science (ORIE)
Science of Earth Systems (EAS)

Additional information on specific 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 in Business for Engineering Students**

The Department of Applied Economics and Management in the College of Agriculture and Life Sciences offers a Minor in Business for Engineering Students on a selective basis. OR&E students are not allowed to complete this Minor due to overlapping content. All engineering students, except those majoring in OR&E, may apply to the Minor at any point during their academic career, beginning in the first semester of their second year. At that time, Engineering students will be in the process of applying to affiliate with an Engineering Major and will need to begin taking the courses required for the Minor. Detailed information can be found under “Minor in Business for Engineering Students” on page 133.
Minor in 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
Engineering undergraduates affiliated with the following Majors are eligible to participate in the Aerospace Engineering Minor: BE, ChemE, CE, CS, ECE, EnvE, EP, ISST, ME, MSE, OR&E, and SES. Mechanical Engineering degree candidates may participate in this Minor. Pre-approval for the Aerospace Engineering Minor is required. Students intending to earn a Minor in Aerospace Engineering should seek advice and pre-approval of their Minor academic program 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 3060 (or both).
   (b) Select at most two courses from group B. No courses from group C may be used.
   (c) You may use at most four courses to satisfy both the Aerospace Engineering Minor requirements and the requirements for the B.S. in Mechanical Engineering. The Major concentration courses may not be among these overlapped courses.

3. Rules for other Majors:
   (a) Select at least four courses from group A, of which you must choose MAE 3050 or MAE 3060 (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 3060: Spacecraft Engineering
MAE/ECE 4150: GPS: Theory and Design
MAE 4291\(^3\): Supervised Senior Design Experience (with Aerospace focus)
or MAE 4900\(^8\): Special Investigations in Mechanical and Aerospace Engineering
(with Aerospace focus)
MAE 4230/5230: Intermediate Fluid Dynamics
MAE 5060: Aerospace Propulsion Systems
MAE 5070: Dynamics of Flight Vehicles

Group B: Courses Applicable to Aerospace Engineering
MAE 4170/5170: Introduction to Robotics: Dynamics, Control, Design
MAE 4550/CEE 4770/MSE 5550/TAM 4550: Introduction to Composite Materials
MAE 4700/5700: Finite Element Analysis for Mechanical and Aerospace Design
or CEE 4720: Introduction to the Finite Element Method
MAE 4770/5770: Engineering Vibrations
MAE 4780/MAE 5780/CHEME 4720/ECE 4720: Feedback Control Systems
MAE 5430: Combustion Processes
MAE 5710: Applied Dynamics
or TAM 5700: Intermediate Dynamics

Group C: Fundamentals
ENGRD 2020: Mechanics of Solids
ENGRD 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 a grade of 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 in Applied Mathematics
Offered jointly by: Department of Theoretical and Applied Mechanics and Department of Mathematics
Contact: Professor Richard Rand, 207 Kimball Hall, 255.7145, 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
At least six (6) courses beyond MATH 2940, to be chosen as follows:
(a) At most one course may be chosen from any one of groups 1, 2, 3, or 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 3210: Mathematical Physics I
MATH 3210: Manifolds and Differential Forms
MATH 4200: Differential Equations and Dynamical Systems
TAM 3100: Introduction to Applied Mathematics I

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 Random Signals
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 Processing
MAE 3230: Introductory Fluid Mechanics
MSE 3030: Thermodynamics of Condensed Systems

Group 5. Advanced Courses
Only one of the following three may be chosen:
AEP 3220: Mathematical Physics II
MATH 4220: Applied Complex Analysis
TAM 3110: Introduction to Applied Mathematics II

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

Only one of the following two may be chosen:
MAE 5710: Applied Dynamics
TAM 5700: Intermediate Dynamics

Also, you may choose from:
CS 3810: 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
TAM 5780: Nonlinear Dynamics and Chaos
TAM 6100: Methods of Applied Mathematics I
TAM 6110: Methods of Applied Mathematics II

Engineering Minors: Applied Mathematics
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 TAM 3110 or AEP 3220 is chosen from group 5.
(iv) Only one of the following may be chosen:
    MATH 3320: Algebra and Number Theory
    MATH 3360: Applicable Algebra

Academic Standards

At least a grade of C for each course in the Minor.
Minor in Biological Engineering
Offered by: Department of Biological and Environmental Engineering
Contact: BEE Major Coordinator, 207 Riley-Robb Hall

Eligibility
Students in all Majors except Biological Engineering may participate in this Minor.

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 Major 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. The Biological Engineering 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)
   BIOBM 3300 or 3310–3320: Principles of Biochemistry
   BIOMI 2900: General Microbiology Lectures
   BIONB 2220: Neurobiology and Behavior II: Introduction to Neurobiology

II. Biological Engineering Core (at least one but no more than two courses)
   BEE 2600: Principles of Biological Engineering
   BEE 3310: Bio-Fluid Mechanics
   BEE 3500: Biological and Environmental Transport Processes
   BEE 3600: Molecular and Cellular Bioengineering

III. Biological Engineering Concentration Electives (Minimum of three courses)
   Choose any three courses from the concentration lists below. Courses appearing in more than one concentration do not double count. BEE 3600 may be taken as either a concentration elective or a core course.
Biomedical Engineering Concentration
AEP 4700: Biophysical Methods
BEE 3600: Molecular and Cellular Bioengineering
BEE 3650: Properties of Biological Materials
BEE 4500: Bioinstrumentation
BEE 4530: Computer-Aided Engineering: Applications to Biomedical Processes
BEE 4540: Physiological Engineering
BEE 4590: Biosensors and Bioanalytical Techniques
BME 3300: Introduction to Computational Neuroscience
BME 4010: Biomedical Engineering Analysis of Metabolic and Structural Systems
BME 4420: Instrumentation for Biology
BME 5020: Biomedical System Design
BME 5390: Biomedical Materials and Devices for Human Body Repair
BME 5650: Biomechanical Systems—Analysis and Design
CHME 4810: Biomedical Engineering
ECE 5780: Computer Analysis of Biomed Images
MAE 4630: Neuromuscular Biomechanics
MAE 4640: Orthopaedic Tissue Mechanics
MAE 4660: Biomedical Engineering Analysis of Metabolic and Structural Systems
MSE 4610: Biomedical Materials and Their Applications

Bioprocess Engineering Concentration
BEE 3600: Molecular and Cellular Bioengineering
BEE 4500: Bioinstrumentation
BEE 4530: Computer-Aided Engineering: Applications to Biomedical Processes
BEE 4590: Biosensors and Bioanalytical Techniques
BEE 4640: Bioseparation Processes
BEE 4840: Metabolic Engineering
CHEM 3000: Quantitative Chemistry (Does not count for Engineering credit)
CHME 3320: Analysis of Separation Processes
CHME 5430: Biomolecular Engineering of Bioprocesses

Bioenvironmental Engineering Concentration
BEE 3710: Physical Hydrology for Ecosystems
BEE 4350: Principles of Aquaculture
BEE 4710: Introduction to Groundwater
BEE 4730: Watershed Engineering
BEE 4780: Ecological Engineering
BEE 6510: Bioremediation: Engineering Organisms to Clean Up the Environment
CEE 4510: Microbiology for Environmental Engineering
CEE 4520: Water Supply Engineering

Academic Standards
At least a grade of C– in each course in the Minor and a GPA ≥2.0 in all courses in the Minor.
Minor in Biomedical Engineering

Offered by: Department of Biomedical Engineering
Contact: Carol Casler, Undergraduate Minor Coordinator, 120 Olin Hall, minor_bme-mailbox@cornell.edu, 255.1489

Eligibility

All undergraduates in the College of Engineering, College of Arts and Sciences, College of Human Ecology, and College of Agriculture and Life Science are eligible to participate in the Biomedical Engineering Minor. 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

• Bioengineering Seminar (1 credit, one semester) and 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 course 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.

Students are asked to complete a form declaring their interest in the Minor with the Biomedical Engineering undergraduate minor coordinator in 120 Olin Hall. On the form, you will be asked to choose a BME faculty advisor that you can consult about your BME Minor plan.

Category 1. Introductory Biology (maximum of 4 credits toward the Minor. Select one listing to fulfill category 1)

A score of 5 on (CEEB) Advanced Placement Biology
A score of 4 on (CEEB) Advanced Placement Biology and ENGRI 1310: Introduction to Biomedical Engineering
A score of 4 on (CEEB) Advanced Placement Biology and BIOG 1103 or BIOG 1104: Biological Sciences, Laboratory
BIOG 1101/1103, and 1102/1104: Biological Sciences, Lectures and Laboratory
BIOG 1105 and 1106: Introductory Biology
BIOG 1107 and 1108: General Biology
BIOG 1110: Biological Principles and ENGRI 1310: Introduction to Biomedical Engineering

Category 2. Advanced Biology
BIOAP 3110/VTBMS 3460: Introductory Animal Physiology, Lectures
BIOBM 3300: Principles of Biochemistry, Individualized Instruction
BIOBM 3310: Principles of Biochemistry, Proteins and Metabolism
BIOBM 3320: Principles of Biochemistry: Molecular Biology
BIOBM 3330: Principles of Biochemistry, Proteins, Metabolism, and Molecular Biology
BIOGD 2810: Genetics
BIOMI 2900: General Microbiology Lectures
BIONB 2220: Neurobiology and Behavior II: Introduction to Neurobiology

Category 3. Molecular and Cellular Biomedical Engineering
AEP/ENGRD 2520: The Physics of Life
BEE/BME 3600: Molecular and Cellular Bioengineering
BME 3010/CHEME 4010α: Molecular Principles of Biomedical Engineering
BME 3020/CHEME 4020α: Cellular Principles of Biomedical Engineering

Category 4. Biomedical Engineering Analysis of Physiological Systems
BEE 4540: Physiological Engineering
BIONB/BME/COGST/PSYCH 3300: Introduction to Computational Neuroscience
BIONB/BME 4910: Principles of Neurophysiology
BME 4010/MAE 4660α: Biomedical Engineering Analysis of Metabolic and Structural Systems
BME 4020α: Electrical and Chemical Physiology
CHEME/BME 4810: Biomedical Engineering
MAE/BME 4640: Orthopaedic Tissue Mechanics

Category 5. Biomedical Engineering Applications
AEP 4700/BIONB 4700/BME 5700: Biophysical Methods
BEE 3650: Properties of Biological Materials
BEE 4500: Bioinstrumentation
BEE/MAE 4530: Computer-Aided Engineering: Applications to Biomedical Processes
BEE 4590: Biosensors and Bioanalytical Techniques
BME 4110: Science and Technology Approaches to Problems in Human Health

Integrating Biology into the Engineering Curriculum
BME 5810/MAE 5680: Soft Tissue Biomechanics
ECE 5020/BME 5020: Biomedical System Design
ECE 5780: Computer Analysis of Biomed Images
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

Required
BME/BEE 5010: Bioengineering Seminar

Academic Standards
At least a grade of C– in each course in the Minor. A GPA ≥2.0 for all courses in the Minor.

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 in 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
Students in all Majors except Civil Engineering may participate in this Minor.

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 economy.

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 4440: Environmental Site and Remediation Engineering

Structural Engineering
CEE 3710: Structural Modeling and Behavior
CEE 3720: Intermediate Solid Mechanics
CEE 4710: Fundamentals of Structural Mechanics
CEE 4720: Introduction to the Finite Element Method
CEE 4730: Design of Concrete Structures
CEE 4740: Design of Steel Structures
CEE 4780: Structural Dynamics and Earthquake Engineering

Other Related Courses
CEE 5950: Construction Planning and Operations
Academic Standards
At least a grade of C in each course in the Minor.

Note

a. Other CEE courses approved by petition in advance.
Minor in Computer Science
Offered by: Department of Computer Science
Contact: Nicole Roy, 303 Upson Hall, 255.0982, nicole@cs.cornell.edu

Eligibility
Students in all Majors except Computer Science and Information Science, Systems, and Technology may participate in this Minor.

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.

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

Required Courses
CS/ENGRD 2110: Object-Oriented Programming and Data Structures
CS/ENGRD 3220: Introduction to Scientific Computation
or
CS 4210: Numerical Analysis and Differential Equations
or
CS 4220: Numerical Analysis: Linear and Nonlinear Equations
CS 3410: Systems Programming
or
CS 3420/ECE 3140: Computer Organization

Additional Courses
Three (3) CS courses numbered 3000 or higher, with the following exceptions:
CS 4999 and seminars are excluded.
CS 2800 is allowed.

Academic Standards
At least a grade of C in each course in the Minor.

Note
Cross-listed courses cannot be applied to the Minor unless taken as CS (e.g., CS 4300 counts, but INFO 4300 does not), with the sole exception of ECE 3140. All qualifying courses must be taken at Cornell for a letter grade. No substitutions allowed.
Minor in Electrical and Computer Engineering
Offered by: School of Electrical and Computer Engineering
Contact: ECE Undergraduate Major Coordinator, 223 Phillips Hall

Eligibility
Students in all Majors except Electrical and Computer Engineering may participate in this Minor.

Educational Objectives
The School of Electrical and Computer Engineering offers a Minor to students who wish to complement their Major by obtaining a background in electrical and computer engineering. The Minor offers the opportunity to study analog and digital circuits, signals and systems, electromagnetic fields, and additionally 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: Signals and Information
ENGRD/ECE 2300: Introduction to Digital Logic Design

Two (2) of the following
ECE 3030: Electromagnetic Fields and Waves
ECE 3100: Introduction to Probability and Random Signals
ECE 3140/CS 3420: Computer Organization
or
CS 3410: Systems Programming
ECE 3150: Introduction to Microelectronics

One (1) other non-project ECE course at the 3000 level or above (3-credit minimum)
One (1) other non-project ECE course at the 4000 level or above (3-credit minimum)

Academic Standards
The grades and grade point averages for courses used to satisfy the Electrical and Computer Engineering Minor must meet the same requirements as the Electrical and Computer Engineering Major: at least a grade of C– for every course in the Minor and a GPA ≥2.3 for all courses in the Minor.
Minor in 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
Students in all Majors may participate in this Minor. (CE Majors may not use courses to fulfill the Minor requirement and simultaneously as a Major-approved Elective or as a Design course.) OR&E Majors have some specific restrictions and requirements as noted below.

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\textsuperscript{a}: Financial and Managerial Accounting
CEE 3040\textsuperscript{b}: Uncertainty Analysis in Engineering
or
ENGRD 2700: Basic Engineering Probability and Statistics
or
ECE 3100: Introduction to Probability and Random Signals

Additional Courses (choose any three)\textsuperscript{c}
CEE 4060: Civil Infrastructure Systems
CEE 4920: Engineers for a Sustainable World: Engineering in International Development
CEE 5930\textsuperscript{d}: Engineering Management Methods:
CEE 5940\textsuperscript{d}: Economic Methods for Engineering and Management
CEE 5950: Construction Planning and Operations
CEE 5960: Management Issues in Forensic Engineering
CEE 5970: Risk Analysis and Management
CEE 5980: Intro to Decision Analysis
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 a grade of C in each course in the Minor.

Notes
a. OR&E Majors must substitute NCC 5560: Managerial Finance or NBA 5000: Intermediate Accounting for ORIE 3150.

b. TAM 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 OR&E Majors.
Minor in Engineering Statistics
Offered by: Department of Statistical Science and School of Operations Research and Information Engineering
Contact: OR&E Undergraduate Major Consultant, 203 Rhodes Hall, 255.5088.

Eligibility
Students in all Majors except Operations Research and Engineering may participate in this Minor.

Educational Objectives
This Minor requires the student to develop expertise in engineering statistics. The goal of the program is to provide the student with 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 a grade of C– in each course in the Minor and a GPA ≥2.0 in all courses in the Minor.

Notes

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 Department of Statistical Science.

A student may not receive credit for more than one Minor offered by the School of Operations Research and Information Engineering.
Minor in Environmental Engineering

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

Eligibility

Students in all Majors except Environmental Engineering may participate in this Minor. Students majoring in Biological Engineering or Civil Engineering are eligible if they are not following the Environmental Concentration offered by those Majors. Eligible Civil Engineering students may not use courses to fulfill the Minor requirement and simultaneously as a Major-approved Elective or as a Design course.

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. 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 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 for a Sustainable Society
CEE 3510: Environmental Quality Engineering
CEE 4510: Microbiology for Environmental Engineering
CEE 4520: Water Supply Engineering
CEE 4530: Laboratory Research in Environmental Engineering
CEE 4540: Sustainable Small-Scale Water Supplies
CEE 4550: AguaClara: Sustainable Water Supply Project
CEE 4920: Engineers for a Sustainable World: Engineering in International Development
BEE 4760: Solid Waste Engineering
BEE 4780: Ecological Engineering
CEE 4440: Environmental Site and Remediation Engineering
BEE 6510: Bioremediation: Engineering Organisms to Clean Up the Environment
BEE/EAS 4800: Introduction to Atmospheric Chemistry
CEE 6530: Water Chemistry for Environmental Engineering
CEE 6560: Physical/Chemical Process
CEE 6570: Biological Processes
CEE 6580: Biodegradation and Biocatalysis

Group B. Environmental Systems
ENGRI 1130: Water Treatment Design (May count only if taken before the third year)
BEE 4750: Environmental Systems Analysis
CEE 5970: Risk Analysis and Management
CEE 6230: Environmental Quality Systems Engineering

Group C. Hydraulics, Hydrology, and Environmental Fluid Mechanics
CEE 3310: Fluid Mechanics (CHME 3230: Fluid Mechanics or MAE 3230: Introductory Fluid Mechanics may be substituted for CEE 3310)
CEE 3320: Hydraulic Engineering
BEE 3710: Physical Hydrology for Ecosystems
BEE 4710: Introduction to Groundwater
CEE 4320: Hydrology
CEE 4360: Case Studies in Environmental Fluid Mechanics
CEE 4370: Experimental Methods in Fluid Dynamics
BEE 4730: Watershed Engineering
BEE 4740: Water and Landscape Engineering Applications
CEE 6310: Computational Simulation of Flow and Transport in the Environment
CEE 6330: Flow in Porous Media and Groundwater
CEE 6550: Transport, Mixing, and Transformation in the Environment
BEE 6710: Analysis of the Flow of Water and Chemicals in Soils
BEE 6720: Drainage

Academic Standards
At least a grade of C– in each course in the Minor and a GPA ≥2.0 in all courses in the Minor.
Minor in Game Design
Offered by: Department of Computer Science
Contact: Nicole Roy, 303 Upson Hall, 255.0982, nicole@cs.cornell.edu

Eligibility
Students in all Engineering Majors may participate in this 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, 303 Upson Hall.

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

Required Courses: Complete the following two courses:
CIS 3000: Introduction to Computer Game Design
CIS 4002: Advanced Projects in Game Design

Additional Courses: Choose four of the following 12 courses:

CS-focused courses:
CS/ENGRD 2110: Object-Oriented Programming and Data Structures
CS 4450: Computer Networks
CS 4620/ARCH 3704: Introduction to Computer Graphics
CS 4700: Foundations of Artificial Intelligence
CS 5620: Interactive Computer Graphics
CS 5643: Physically Based Animation for Computer Graphics
Other courses:
CIS 5640/ART 2703 (CS 5640 not allowed): Computer Animation
COMM 4220: Psychology of Entertainment
ECE 4760: Digital Systems Design Using Microcontrollers
INFO/COMM 3450: Human–Computer Interaction Design
INFO/COMM 4400: Advanced Human–Computer Interaction Design

Academic Standards
At least a letter grade of C is required for each course in the Minor.

Note
CS Majors may not count courses from the CS-focused list toward the completion of this Minor.
Minor in Industrial Systems and Information Technology
Offered by: School of Operations Research and Information Engineering
Contact: OR&E Undergraduate Major Consultant, 203 Rhodes Hall, 255.5088.

Eligibility
Students in all Majors except Information Science, Systems, and Technology, and Operations Research and Engineering may participate in this Minor.

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 a grade of C– in each course in the Minor and a GPA ≥2.0 in all courses in the Minor.

Note
A student may not receive credit for more than one Minor offered by the School of Operations Research and Information Engineering.
Minor in Information Science
Offered by: Department of Computer Science
Contact: Christine Stenglein, 303 Upson Hall, 255.9837, minor@infosci.cornell.edu

Eligibility
Students in all Majors except Information Science, Systems, and Technology may participate in this Minor. Students interested in pursuing the Information Science Minor must initiate the process by sending an e-mail 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
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

Statistics
An introductory course that provides a working knowledge of basic probability and statistics and their application to analyzing data occurring in the real world.
CEE 3040: Uncertainty Analysis in Engineering
ENGRD 2700: Basic Engineering Probability and Statistics

Information Systems
CS 2110a: Object-Oriented Programming and Data Structures
CS 4320: Introduction to Database Systems
CS 4620: Introduction to Computer Graphics
CS 4700: Foundations of Artificial Intelligence
CS 4780: Machine Learning
CS 5150: Software Engineering
CS 5430: System Security
CS 5300: The Architecture of Large-Scale Information Systems
CS 5780: Empirical Methods in Machine Learning and Data Mining
CIS 3000: Introduction to Computer Game Design
ECE 5620: Fundamental Information Theory
INFO 2300\textsuperscript{a}: Intermediate Design and Programming for the Web
INFO 3300: Data-Driven Web Applications
LING 4424: Computational Linguistics
INFO 4300: Information Retrieval
INFO 4302: Web Information Systems
LING 4474: Introduction to Natural Language Processing
ORIE 4800: Information Technology
ORIE 4810: Delivering OR Solutions with Information Technology
ORIE 4850: Applications of Operations Research and Game Theory to Information Technology

Human-Centered Systems
COGST 1101: Introduction to Cognitive Science
DEA 4700: Applied Ergonomic Methods
INFO 2140: Cognitive Psychology
INFO 2450: Psychology of Social Computing
INFO 3450: Human–Computer Interaction Design
INFO 3650: Technology in Collaboration
INFO 4400: Advanced Human–Computer Interaction Design
INFO 4450: Seminar in Computer-Mediated Communication
INFO 4500: Language and Technology
PSYCH 2050: Perception
PSYCH 2800: Introduction to Social Psychology
PSYCH 3470: Psychology of Visual Communications
PSYCH 3800: Social Cognition
PSYCH 4130: Information Processing: Conscious and Nonconscious
PSYCH 4160: Modeling Perception and Cognition

Social Systems
AEM 3220\textsuperscript{a}: Internet Strategy
ECON 3010\textsuperscript{a}: Microeconomics
ECON 3130\textsuperscript{a}: Intermediate Microeconomic Theory
ECON 3680\textsuperscript{a}: Game Theory
ECON 4190: Economic Decisions Under Uncertainty
ECON 4760/4770: Decision Theory I and II
HADM 5574*: Strategic Information Systems
INFO 2040: Networks
INFO 2921: Inventing an Information Society
INFO 3200: New Media and Society
INFO 3490: Media Technologies
INFO 3551: Computers: From the 17th Century to the Dotcom Boom
INFO 3561: Computing Cultures
INFO 3660: History and Theory of Digital Art
INFO 3871: The Automatic Lifestyle: Consumer Culture and Technology
INFO 4290: Copyright in the Digital Age
INFO 4144: Responsive Environments
INFO 4470: Social and Economic Data
INFO 4850: Computational Methods for Complex Networks
INFO 5150: Culture, Law, and Politics of the Internet
ORIE 4350*: Introduction to Game Theory
SOC 3040: Social Networks and Social Processes
STS 2501: Technology in Society
STS 4111: Knowledge, Technology, and Property

Academic Standards
At least a grade of C in each course in the Minor. All courses for the Minor must be
taken at Cornell.

Note
a. Computer Science Majors cannot use INFO 2300. CS 2110 cannot be used by Majors for whom it is a
required course, e.g., Computer Science and Operations Research and Engineering. Only one of ECON
3010 and ECON 3130 can be taken for IS credit. Only one of ORIE 4350 and ECON 3680 can be taken
for IS credit. Only one of AEM 3220 and HADM 5574 can be taken for IS credit.
Minor in Materials Science and Engineering
Offered by: Department of Materials Science and Engineering
Contact: MSE Undergraduate Program Director, 214 Bard Hall, 255.9159

Eligibility
Students in all Majors except Materials Science and Engineering may participate in this Minor.

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 a grade of C in each course in the Minor.
Minor in Mechanical Engineering
Offered by: Sibley School of Mechanical and Aerospace Engineering
Contact: MAE Undergraduate Coordinator: 108 Upson Hall, 255.3573, np18@cornell.edu

Eligibility
Engineering undergraduates affiliated with the following Majors are eligible to participate in the Mechanical Engineering Minor: BE, ChemE, CE, CS, ECE, EnvE, EP, ISST, MSE, OR&E, and SES.

Students intending to earn a Minor in Mechanical Engineering should seek advice and pre-approval of their Minor academic program 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 will dictate, to a large extent, that a student concentrate in a subarea of mechanical engineering. Many upper-level MAE courses have multiple prerequisites. 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 ENGRD 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, ENGRD 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 ENGRD 2030. No substitutions will be accepted from other departments at Cornell or elsewhere. Transfer credit cannot be used to satisfy the ME Minor. MAE 1110: Naval Ship Systems, or 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 a grade of C– in each course in the Minor
Minor in Operations Research and Management Science
Offered by: School of Operations Research and Information Engineering
Contact: OR&E Undergraduate Major Consultant, 203 Rhodes Hall, 255.5088

Eligibility
Students in all Majors except Operations Research and Engineering and Information Science, Systems and Technology may participate in this Minor.

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 a grade of C– in each course in the Minor and a GPA ≥2.0 in all courses in the Minor.

Note
A student may receive credit for at most one Minor offered by the School of Operations Research and Information Engineering.
Minor in Science of Earth Systems
Offered by: Department of Earth and Atmospheric Sciences
Contact: 2124 Snee Hall, 255.5466, www.eas.cornell.edu

Eligibility
Students affiliated with all Majors except Science of Earth Systems are eligible to participate.

Educational Objectives
Some of the major problems facing mankind in this century involve earth science, and engineering 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 six (6) courses (≥18 credits), chosen as follows:

Required introductory course
EAS 2200: The Earth System

At least two selections from the following core courses:
EAS 3010: Evolution of the Earth System
EAS 3030: Introduction to Biogeochemistry
EAS 3040: Interior of the Earth
EAS 3050: Climate Dynamics

Additional EAS courses at the 3000 level or higher.
These may include additional courses from the above list, undergraduate research courses, and outdoor field courses.

Academic Standards
At least a grade of C– in each course in the Minor and a GPA ≥2.0 in all courses in the Minor.
Minor in Business for Engineering Students
Offered by: College of Agriculture and Life Sciences
Contact: AEM Undergraduate Program, 150 Warren Hall

Eligibility
All Engineering undergraduates are eligible to apply beginning the first semester of their second year. Acceptance into the minor is on a selective basis. An application form is available to students on the Engineering college web site, and in 167 Olin Hall and 150 Warren Hall. A deadline for applications that falls before pre-enrollment will be established each semester.

Educational Objectives
This Minor provides a focus for Engineering students interested in business.

Requirements
ECON 1110: Introductory Microeconomics or equivalent (including AP credit as equivalent)

AEM 2100: Introductory Statistics
or
ILRST 2100: Introductory Statistics
or
PAM 2100: Introduction to Statistics
or
ENGRD 2700: Basic Engineering Probability and Statistics\(^a\)
or
CEE 3040: Uncertainty Analysis in Engineering or equivalent (including AP credit as equivalent)

AEM 2210: Financial Accounting
or
ORIE 3150: Financial and Managerial Accounting\(^b\)

AEM 2200: Introduction to Business Management

AEM 2400: Marketing

AEM 3230: Managerial Accounting

Academic Standards
A C– or better in all courses counting toward the Minor.

\(^a\) ECE 3100, which is allowed as a substitute for ENGRD 2700 in some majors in Engineering, is not allowed as a substitute in the Minor in Business for Engineering Students.

\(^b\) These courses will not satisfy the two-semester sequence in financial and managerial accounting needed for AEM majors. Any Engineering student contemplating a transfer to AEM as a Major should be aware that AEM 2210: Financial Accounting and AEM 3230: Managerial Accounting will still be required for the AEM major.
Special Programs

Dual-Degree Option

The dual-degree program is intended for superior students. Students in the program can earn both Bachelor of Science and either a Bachelor of Arts or Bachelor of Fine Arts degree in about five years. Students registered in the College of Engineering, the College of Arts and Sciences, or the College of Architecture, Art, and Planning may apply and, after acceptance of their application, begin the dual-degree program in their second or third year. Contact the appropriate coordinators of dual-degree programs at the following locations for more information: 55 Goldwin Smith Hall (for Arts and Sciences) or B1 Sibley (for Architecture, Art, and Planning); and Engineering Advising, 167 Olin Hall.

Ordinarily, students need at least ten semesters to complete a dual-degree program, although exceptional students may be able to arrange an accelerated program and have it approved by petition. Such a program may not rely on summer work or credits earned at community colleges. Students who run into trouble are not required to finish the work for both degrees, 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 option makes it possible to develop expertise in two allied engineering disciplines. Students must complete all the requirements of two different Majors, which generally requires at least one semester beyond the usual four years. (Students dependent on financial aid who spend more than eight semesters as an undergraduate will need to change their financial-aid package.)

A student who wants to embark on a double Major must complete the prerequisites for entry into both Major programs and have a cumulative GPA $\geq 3.0$ after the first four semesters. Affiliation with the first Major proceeds in the usual manner. Before the end of the third year, the student presents a Petition for Double Major form to enter the second Major. The Petition for Double Major form must include a plan of study, and it requires the formal approval of the faculty in both Majors and the Committee on Academic Standards, Petitions, and Credit (ASPAC). The second Major may set its own requirements, and admission is not guaranteed. (Petition for Double Major forms are available from Engineering Advising and should be returned to the Engineering Registrar, 158 Olin Hall when completed.)

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.

Double-Major students must meet the standards for academic performance set by both Majors, although the consequences for failing to do so for one or the other are somewhat different. A required leave of absence from the primary Major results in a required leave of absence from the college, while deficient performance in the secondary Major simply terminates the double Major. Similarly, a student withdrawn from the primary Major is withdrawn from the college, while a student withdrawn
from the secondary Major may be allowed to continue, with the permission of the primary Major.

Further information is available from Engineering Advising, 167 Olin Hall, and the individual Major consultant offices.

The Independent Major

The Independent Major is a special opportunity for students whose educational objectives cannot be met by any of the regular Majors. This option allows students to create a specially tailored, interdisciplinary course of study. The program is developed by the student in consultation with faculty advisors and must be approved by the Independent Major Committee, which is responsible for overseeing the student’s work.

Every curriculum developed under the Independent Major, with the exception of certain faculty-sponsored programs, includes a primary engineering area of ≥32 credits and an educationally related secondary area of ≥16 credits. The primary engineering area may be any subject area offered by the schools or departments of the college; the secondary area may be in a logically connected area taught anywhere in the university. The overall program must clearly constitute an engineering education in scope and substance, and all requirements of the Common Curriculum must be met.

Students who wish to enter the Independent Major should apply by the end of the first semester of the second year and must be in good academic standing. 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 on the Independent Major, contact Engineering Advising, 167 Olin Hall.

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

Minor in Business for Engineering Students

The Department of Applied Economics and Management in the College of Agriculture and Life Sciences offers a Minor in Business for Engineering students on a selective basis. (Due to overlapping course content, OR&E Majors are ineligible to take this Minor.) Engineering students may apply to the Minor at any point during their academic career, beginning in the first semester of their second year. At that time, Engineering students will be in the process of applying to affiliate with an Engineering Major and will need to begin taking the courses required for the Minor. Detailed information can be found under “Minor in Business for Engineering Students” on page 133.
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 members in the college can suggest a variety of ways for students to study abroad and still meet graduation requirements for Cornell. Students interested in studying or working abroad should begin gathering information early in the first year. These 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.

- The College of Engineering has several study-abroad programs with Ecole Central Paris. A student may elect to study there one or two semesters of junior year, take courses during the summer, or join the “2-2-1” program. In the 2-2-1 program, students spend their first two years at Cornell, the second two years in Paris, and come back to Cornell for a year in the M.Eng. program. See Engineering Advising, 167 Olin Hall, for details.
- Students in several Majors may spend a semester at IIT Kanpur, India.
- Students may spend the fourth semester in Dresden, Germany; Tel Aviv, Israel; or Guadalajara, Mexico, through a program of Boston University.
- Second- and third-year students may spend a semester or two at the Hong Kong University of Science and Technology.
- CE Majors may spend a year at Cantabria, Spain.

On campus, there are several sources of specific information on study abroad:
- Cornell Abroad office, 300 Caldwell Hall
- Engineering Advising, 167 Olin Hall
- the associate director of undergraduate studies in the student’s Major

Engineering Communications Program

The Engineering Communications Program (ECP) provides instruction in technical writing, oral presentation, and the use of graphics in both.

Information about ECP members, courses, annual student awards, and the college’s technical-writing requirement is available at www.engineering.cornell.edu/programs/undergraduate-education/engineering-communications/.

The ECP’s courses give students experience with the task of explaining technical information to audiences having various levels of technical expertise. Students improve their writing style, become more comfortable with and effective at oral presentation, use standard forms and formats for presenting technical information, do library and Internet research on engineering topics, and study engineering ethics.
ECP courses have up to 20 students per section; like writing seminars elsewhere at Cornell, they are discussion classes. Students’ work receives abundant written comments, and conferences are frequent.

The ECP oversees the communications component of the Writing-Intensive Co-op and sits on the College Curriculum Governing Board’s Subcommittee on Technical Writing. Members of the ECP are available to help engineering faculty members develop materials for their own writing and oral-presentation assignments.

Feel free to call 255.8558, visit the ECP’s office at 465 Hollister Hall, or stop at any ECP member’s office elsewhere on the fourth floor of Hollister Hall.

Engineering Cooperative Education Program (Co-op)

Engineering undergraduates can participate in the Engineering Cooperative Education Program (Co-op), which provides an opportunity to gain 28 weeks of career-related practical work experience before they graduate. By supplementing course work with carefully monitored, paid positions, co-op students are able to explore their interests and acquire a better understanding of engineering as a profession.

To be eligible, a student must be enrolled at 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 participating employers in February of the sophomore year. Those who receive offers and join the program usually complete their fifth-semester course work on campus during the summer after sophomore year, and begin the first co-op work term the following fall. They complete the sixth semester back on campus with their classmates, and then return to their co-op employer (not necessarily to the same department or location) the following summer to complete a second work term. Students then spend the senior year back on campus, graduating on schedule with their class. Students who have flexible course curriculums may prefer to complete one spring/summer or summer/fall co-op work term during the junior year. Co-op employers and work locations may be local, national, or international, and with advanced planning, the co-op experience may be combined with Study Abroad opportunities.

Further information may be obtained at www.engineering.cornell.edu/co-op or at the Engineering Cooperative Education and Career Services office, 201 Carpenter Hall, 255.3512.

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 field. 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. Projects usually involve one student and one professor, although some projects may involve student teams. 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/student-services/learning/index.cfm/.

Leadership and Teamwork Opportunities
Numerous opportunities exist for engineering undergraduate students to participate in co-curricular and classroom activities that can develop leadership and teambuilding skills. There are more than 30 engineering student organizations, including engineering honor societies, Major-specific organizations, and active chapters of the Society of Women Engineers (SWE), the National Society of Black Engineers (NSBE), the Society of Hispanic Professional Engineers (SHPE), and the American Indian Science and Engineering Society (AISES).

Other opportunities for developing teamwork and leadership skills include peer-educator experiences such as peer advisors, undergraduate teaching assistants, Academic Excellence Workshop facilitators, tutoring, Encourage Youth, Educate Society (EYES), and program assistants for pre-freshman programs offered through Engineering Student Services.

CU Emerge
CU Emerge is a six-week leadership institute that provides instruction and experiences to help students develop fundamental skills and attitudes consistent with responsible and effective leadership. “Team Building,” “Communication and Group Dynamics,” “Building Inclusive Teams,” and “Event Planning” are some of the topics addressed. The goal of the institute is to help prepare selected freshmen and sophomores for leadership roles while here at Cornell and beyond. For more information, contact Linda J. Tompkins at LT57@cornell.edu.

Cooperative Programs with The Johnson School at Cornell University
Two programs make it possible for students to earn degrees from both the College of Engineering and the Johnson School.

The Knight Scholarship Program supports students who pursue both an M.Eng. and an M.B.A. from Cornell. Students must apply and be accepted to each program independently. Upon completion of the M.Eng. degree, students can choose to pursue their M.B.A. immediately through the Accelerated M.B.A. (AMBA) program, or can defer their enrollment at the Johnson School for three to five years. The
application process for the Knight Scholarship is separate and independent from the admissions application process. Undergraduates should begin the application process for the Knight Program in the fall semester of their fourth year.

The Five-Year Program leads to a B.S. degree in engineering and an M.B.A. The Six-Year Program leads to three degrees: the B.S. in Engineering, the M.Eng., and the M.B.A. Both the Five- and Six-Year programs are highly selective and opportunities are limited. The programs require students to save a number of free electives until their senior year in order to complete the Core Curriculum of the Johnson School during that year.

Students who decide to pursue any of these programs must apply separately to the College of Engineering and the Johnson School. Students are also required to take the Graduate Management Admission Test (GMAT) prior to applying to the Johnson School.

For more information, stop by the admissions office of the Johnson School, 111 Sage Hall.
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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 the student has no academic or judicial holds preventing registration. Just the Facts/Student Center, an online student service on Bear Access, 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 Cornell’s electronic add/drop system on Just the Facts/Student Center to make most of their course-enrollment changes. Some “permission only” courses may require students to submit an add/drop form, which can be obtained 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 either online through Bear Access or in the Course and Time Roster, which is available in the Engineering Registrar’s office.)
- 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.

The completed add/drop form should be delivered in person to the Engineering Registrar’s office in 158 Olin Hall. There, a staff member will process the changes and return one copy of the form to the student. It is important that students keep
this record of the change and check their schedules periodically on Bear Access during the semester for accuracy.

Adding a Course

Students may add courses to their schedule at any time before the end of the third week of classes, using Cornell’s electronic add/drop system or an add/drop form mentioned in the previous section for “permission only” courses.

After the end of the third week of classes, a petition (available in the Engineering Registrar’s office, 158 Olin Hall) will be required in addition to the add/drop form to add a course. Like the add/drop form, the petition must be endorsed by the student’s advisor. The completed petition and add/drop form should be submitted to Engineering Advising, 167 Olin Hall.

Dropping a Course

Students may drop courses from their schedule at any time before the end of the seventh week of classes, using Cornell’s electronic add/drop system or an add/drop form mentioned earlier for “permission only” courses.

During weeks 8 to 12 (after the end of the seventh week of classes and before the end of the twelfth week), a petition (available in the Engineering Registrar’s office, 158 Olin Hall) will be required in addition to the add/drop form to drop a course. Like the add/drop form, the petition must be signed by the student’s academic advisor. The completed petition and add/drop form should be submitted to Engineering Advising, 167 Olin Hall.

Courses dropped after the seventh week will be automatically marked with a “W” (for withdrawal) on the official transcript where the grade would normally appear. “W” is a matter of record: its removal cannot be petitioned.

No courses may be dropped following the end of the twelfth week of classes, even with a petition.

Changing a Grade Option

During weeks one to three of the semester, changing a grade option (on courses where a choice between letter or S/U grade is offered) may be accomplished with 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. The completed add/drop form should be submitted to the Engineering Registrar’s office, 158 Olin Hall, by the end of the third week of classes.

Important: After the end of the third week of classes, 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 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 at the time they enroll in the course, in consultation with the instructor and their faculty advisor. (For example, a course might be listed as “variable to 5 credits.” This means that a student could enroll in the course for as many as 5 credit hours, although options involving 4 or fewer credit hours exist.)

During weeks one to three of the semester, changing credit hours (on courses that offer variable credit) may be accomplished with 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 third week of classes.

After the end of the third week of classes, variable credit hours may not be changed except by petition (see previous section on “adding a class after week three” for specific instructions).

Course Pre-Enrollment through CoursEnroll

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

Each semester, the University Registrar’s office assigns each class (first- through fourth-year) a designated time period during which CoursEnroll will be accessible through Just the Facts. This access schedule will be published in written form by the University Registrar’s office and in the weekly e-mail newsletter, The Sundial.

To request courses through CoursEnroll, students should

• determine their pre-enrollment access period by reading The Sundial or by contacting the Engineering Registrar’s office, 158 Olin Hall.

• check the online Course and Time Roster or view classes via Just the Facts.

• decide which courses they want to take for the next semester, keeping in mind the requirements for both the Common Curriculum and their intended Major program.

• make an appointment to meet with their faculty advisor prior to the pre-enrollment period. During this meeting, the student and their advisor will discuss the proposed course schedule and make changes as necessary.

• use CoursEnroll to enter their course choices.

This formally completes the pre-enrollment process.
Maximum Number of Credits per Semester

The College of Engineering permits (but does not encourage) students to take a maximum of 23 credits a semester—excluding physical education courses, supplementary courses, and other courses that do not count toward the degree. Those who wish to attempt more than 23 credits must petition to do so. Add/drop forms that result in a schedule of more than 23 credits will not be processed without a completed petition endorsed by the student’s faculty advisor and approved by a representative of ASPAC in Engineering Advising.

Special Courses

Supplementary Courses

Some Majors offer supplementary courses in which material taught in other courses is reviewed. Although students are encouraged to take advantage of these courses, they cannot be used to fulfill graduation requirements, and grades received do not affect academic or class standing.

ROTC Courses

The use of ROTC courses to fulfill college degree requirements is regulated by the College Curriculum Governing Board. Under current policy, ROTC courses may be used to satisfy engineering degree requirements under these circumstances:

1. up to 6 credits of ROTC courses at or above the 3000-level may be used as advisor-approved electives;

2. ROTC courses which are co-listed by another department. (For example, NAVS 3050: Principles of Navigation is co-listed as BEE 3050.) Some Majors further restrict the use of particular courses co-listed with Military Science, and students should check with their undergraduate coordinator office to find out whether such courses will count toward graduation.

Writing Workshop

The Writing Workshop offers a special writing seminar, An Introduction to Writing in the University, for students who have had little education in composition or who have serious difficulty with writing assignments. This course is graded S/U and does count as a first-year writing seminar. In the fall many students are urged to attend a writing assessment session during Freshman Orientation to see if they would benefit from this seminar. The University Orientation Guide will have full details about the assessment.

At any time during the semester, students enrolled in other writing courses who are having problems with their writing assignments can go to the Writing Workshop office (174 Rockefeller Hall, 255.6349) to discuss their writing with a member of the workshop staff.
English as a Second Language

Many Cornell students are not native speakers of English. Because these students must still take a two-semester sequence of first-year writing seminars, the Writing Program offers a special writing seminar, English for Later Bilinguals, which focuses on language issues. Designed for second-language students whose writing skills are weak, this course allows students to improve their mastery of English while taking a first-year writing seminar. Enrollment is by permission of the instructor. Students interested in this course should take the writing assessment during orientation. The Orientation Guide contains full details about the assessment.
Grades and Credit

Grades

The grading system used at the university is shown below.

<table>
<thead>
<tr>
<th>Letter</th>
<th>Grade Point Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>4.3</td>
<td>Excellent to Very Good: comprehensive knowledge and understanding of subject matter; marked perception and/or originality</td>
</tr>
<tr>
<td>A</td>
<td>4.0</td>
<td>Knowledge and understanding of subject matter; marked perception and/or originality</td>
</tr>
<tr>
<td>A–</td>
<td>3.7</td>
<td>Knowledge and understanding of subject matter; marked perception and/or originality</td>
</tr>
<tr>
<td>B+</td>
<td>3.3</td>
<td>Good: moderately broad knowledge and understanding of subject matter; noticeable perception and/or originality</td>
</tr>
<tr>
<td>B</td>
<td>3.0</td>
<td>Good: moderately broad knowledge and understanding of subject matter; noticeable perception and/or originality</td>
</tr>
<tr>
<td>B–</td>
<td>2.7</td>
<td>Good: moderately broad knowledge and understanding of subject matter; noticeable perception and/or originality</td>
</tr>
<tr>
<td>C+</td>
<td>2.3</td>
<td>Satisfactory: reasonable knowledge and understanding of subject matter; some perception and/or originality</td>
</tr>
<tr>
<td>C</td>
<td>2.0</td>
<td>Satisfactory: reasonable knowledge and understanding of subject matter; some perception and/or originality</td>
</tr>
<tr>
<td>C–</td>
<td>1.7</td>
<td>Satisfactory: reasonable knowledge and understanding of subject matter; some perception and/or originality</td>
</tr>
<tr>
<td>D+</td>
<td>1.3</td>
<td>Marginal: minimum knowledge and understanding of subject matter; limited perception and/or originality</td>
</tr>
<tr>
<td>D</td>
<td>1.0</td>
<td>Marginal: minimum knowledge and understanding of subject matter; limited perception and/or originality</td>
</tr>
<tr>
<td>D–</td>
<td>0.7</td>
<td>Marginal: minimum knowledge and understanding of subject matter; limited perception and/or originality</td>
</tr>
<tr>
<td>F</td>
<td>0.0</td>
<td>Failing: unacceptably low knowledge and understanding of subject matter; severely limited perception and/or originality</td>
</tr>
<tr>
<td>S</td>
<td>–</td>
<td>“Satisfactory” equivalent to C– or above</td>
</tr>
<tr>
<td>U</td>
<td>–</td>
<td>“Unsatisfactory” equivalent to below C–</td>
</tr>
</tbody>
</table>

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 his/her 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 seventh week (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 during the first three weeks 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–; a “U” is equivalent to a grade of D+ or less.)

Important: After the end of the third week of classes, 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 in question must be offered with an S/U option.

• The student must have previously 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 proposed S/U course must count as either a liberal-studies distribution or
  an approved elective in the Engineering curriculum.

• Students may elect to enroll S/U in only one (1) course each semester in which
  the choice between letter grade and S/U is an option. (Additional courses
  offered “S/U only” may be taken in the same semester as the “elected S/U”
  course.)

Note: S/U courses do not count toward eligibility for the Dean’s List and may
weaken a student’s chances for acceptance into graduate school. Address questions
regarding the S/U option to Engineering Advising.

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. Under these circumstances, it
becomes desirable to receive a temporary grade of incomplete and finish up 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 instructor of the course.
Students who think an incomplete is appropriate 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. Having this “contract” in
writing is desirable.

Evidence of an incomplete remains permanently on the student’s transcript. When
the course has been completed, a grade is entered with an asterisk, indicating that it
was not completed during the regular semester. Students should weigh the cost of
taking an incomplete against the reasons for doing so. Students may find it helpful to discuss the matter with their faculty advisor or a staff member in Engineering Advising.

Advanced Placement and Transfer Credit

Where Credit Is Due

Many students begin their careers at Cornell having already completed advanced placement courses in high school or having taken courses 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 (AP) credit and transfer credit. AP credit is awarded when students show their competence in a particular subject by doing well on an approved exam. Transfer credit, on the other hand, is awarded for courses that have been satisfactorily completed at another college and have not been used to meet high school graduation requirements.

The only courses for which students may obtain AP 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.

The Pros and Cons of AP Credit

Advanced placement (or transfer) credit is designed to enable students to begin their college studies at an appropriate level in each subject. They generally profit from these options, but 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 AP or transfer credit—or take the corresponding course—is a decision for which the student, alone, is responsible.

Students may become eligible for AP 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 Cornell departmental examination, given during Orientation week prior to the beginning of the fall term.

If a student’s performance on one of these exams is satisfactory, college credit will be offered.
Advanced Placement (AP) credit need not be accepted.—Choosing to accept AP credit will depend, in part, on whether the course in question 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 feel free to take a departmental exam, even if they have already passed the CEEB AP exam.

Since the amount of AP or transfer credit awarded can affect the degree of difficulty of the first year and subsequent success as an engineering student, students should consider their options carefully, seeking advice from their faculty advisors during Orientation Week and talking with the undergraduate coordinator (see pages 10–12) for their primary Major of interest. The first year at Cornell is crucial to the development of an undergraduate program; wise use of AP and transfer credit can make a positive difference.

Acceptable Subjects and Scores
A table showing the most common subjects for which AP credit is awarded in the College of Engineering, and the scores needed on qualifying tests, follows. In mathematics, physics, chemistry, and computer science, AP credit is awarded only for courses required in the engineering curriculum. (The College of Engineering does not presently award AP credit for statistics.)

Modern Languages
Students may earn AP 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. To qualify for the CASE (in any language), students must score at least a 65 on a college placement test (taken either in high school or at Cornell during Orientation Week). Students achieving a passing score on the CASE will be awarded 3 credits. Modern 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 approved elective requirement, contingent on discussion with the student’s faculty advisor.
Other Subjects

AP 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 or online at http://cuinfo.cornell.edu/Academic/Courses/FM.php.

General Policies for AP Credit

The general policies in the College of Engineering governing awards of AP credit are as follows.

1. AP credit will not be offered in any subject area without a documented examination.

2. All AP 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 Engineering Advising, 167 Olin Hall. Those who wish to take departmental examinations must do so during Orientation Week; permission to take these tests after the start of fall-term classes must be requested in a written petition to the college’s committee on Academic Standards, Petitions, and Credit (ASPAC).
# AP Credit Table

<table>
<thead>
<tr>
<th>Requirements</th>
<th>CEEB AAP Exams</th>
<th>GCE A-Level</th>
<th>IB Higher Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>4 or 5 on BC</td>
<td>A, B, or C on Math or Pure Math exams (1910 only)</td>
<td>No credit&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>1910 required</td>
<td>Cornell Departmental Exam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1920 required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics</td>
<td>4 or 5 on mechanics portion of C; 5 on B with successful completion of a high school level calculus course</td>
<td>A or B</td>
<td>6 or 7</td>
</tr>
<tr>
<td>1112 required</td>
<td>5 on electricity and magnetism portion of C</td>
<td>A or B plus credit for MATH 1910</td>
<td></td>
</tr>
<tr>
<td>1112 and 2213</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry</td>
<td>5</td>
<td>B</td>
<td>6 or 7</td>
</tr>
<tr>
<td>2090&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>2090 and 2080</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computing</td>
<td>5 on A, or 4 or 5 on AB</td>
<td>A or B</td>
<td>6</td>
</tr>
<tr>
<td>CS 1110, 1112, 1113, 1114</td>
<td></td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Biology</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 credits</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 credits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 credits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First-Year Writing Seminar (2 required)</td>
<td>5 (English)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>A</td>
<td>7</td>
</tr>
<tr>
<td>One seminar</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For all other subjects, see Courses of Study or go to: cuinfo.cornell.edu/Academic/Courses/FM.php

## Notes

a. Students are encouraged to take the Cornell departmental examination during orientation.

b. Students who obtain AP credit for CHEM 2090 and are thinking of majoring in ChemE or MSE should consider enrolling in CHEM 2150. Those who are offered AP 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 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 for Advanced Study in High School

College-level courses completed in high school under the auspices of cooperative college/high school programs do not generally lead to Cornell engineering credit. Students who would like credit for such courses should seek Advanced Placement credit by taking a CEEB Advanced Placement or Cornell departmental exam.
Transfer credit for high school courses is awarded only if the course was taught at an accredited college or university, by its own faculty members, and if the student can present a signed statement from the high school registrar certifying that the course was not used to fulfill high school graduation requirements.

General Policies for Transfer Credit

- Cornell does not award transfer credit for courses in which a student earned a grade less than C (not C–); schools and departments may stipulate a higher minimum grade.
- A maximum of 18 transfer or Cornell extramural credits may be applied to engineering degree requirements after a student matriculates at Cornell. (Credit for summer-session courses taken at Cornell cannot be transferred.)
- First-year and transfer students must complete the transfer credit award process by the end of their first semester at Cornell or their registration will be blocked for the next semester until the process is completed.
- Transfer credit will not be awarded without a completed Transfer Credit Form, a detailed course syllabus or outline, and a certified copy of the student’s official transcript (photocopies are not acceptable).
- Transfer credit will not be awarded for courses taken during a semester in which a student is enrolled at Cornell.
- The final transfer credit award is recorded by the Engineering Registrar, 158 Olin Hall. Students should consult the registrar two weeks after submitting the necessary documents to find out the status of the application.
Transfer Credit for First-Year Students

Students who have taken a course or courses at 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, Engineering Advising will work directly with those students who indicate on the Student Information Card that they have taken college-level courses at another institution. These students will be provided additional information by e-mail.

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.
- Engineering Advising must possess a signed statement from the high school registrar certifying that the course has not been used to fulfill high school graduation credit, and that it was taught by college faculty in a college setting.
- An official transcript must be received.
- Transfer credit requests must be completed by the end of the first term of residence or registration will be blocked for the next semester until the process is completed.

Students who want credit for cooperative courses taken in high school must seek AP credit, not transfer credit. Academic credit is never awarded for technical skills and general knowledge acquired through personal experience, employment, or vocational or military training. 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.

Students who are awarded credit will receive documentation of the award at their Academic Briefing during Orientation.

How to Use AP or Transfer Credit

AP 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. (Students must enroll for a minimum of 12 credits each semester to be considered in good academic standing.)

Further Information

For further information about advanced placement or transfer credit, students should contact Engineering Advising, College of Engineering, Cornell University, 167 Olin Hall, Ithaca, NY 14853-5201; telephone: 255.7414, e-mail: adv_engineering@cornell.edu.
Academic Standing

Full-time students are expected to remain in good academic standing. The criteria for good standing change 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 varies from Major to Major.

Requirements for students not yet affiliated with a Major are listed below. Failure to meet these standards will result in a review by the committee on Academic Standards, Petitions, and Credit (ASPAC), 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 engineering students must have:

- at least 12 credits, including at least two courses in mathematics, science, or engineering (PE courses and courses below the 1100 level do not count. Military Science courses do not count, with the exception of courses listed under ROTC Courses, page 144);
- at least a grade of C– in the mathematics course;
- a semester GPA ≥2.0;
- no F, U, or INC grades.

Because mathematics is pivotal to the study and practice of engineering, students must earn at least a grade of C– in MATH 1910, 1920, 2930, or 2940 and a mathematics course chosen by the Major. Students failing to meet this standard must repeat the course immediately and receive a satisfactory grade before enrolling in the next course in the sequence. Failure to achieve at least a grade of C– the second time will result in dismissal from the College of Engineering. Physics and advanced mathematics courses often have mathematics prerequisites, and having to repeat the prerequisite course may delay progress in the physics and mathematics curricula. Students are expected to continue the sequence of core engineering mathematics courses each semester until completed.

Some of the requirements for good standing in Majors are listed below; complete and up-to-date information is available from the undergraduate consultant for each Major.

The university requirement for full-time status (for financial aid) is a minimum of 12 credits, but students who believe they have a good reason to carry a lighter course load should see their faculty advisor and the undergraduate consultant for their Major or intended Major beforehand. Students may have to postpone graduation or attend summer classes as a result of reducing their course load.
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 chosen Major program:

Biological Engineering
(For all Biological Engineering Majors regardless of what college they are enrolled in)
- Semester GPA $\geq 2.0$
- Cumulative GPA $\geq 2.0$
- Semester GPA $\geq 2.0$ in biological and environmental engineering courses and engineering distribution courses
- A passing grade in at least 12 credits each semester
- No failing grades

Chemical Engineering
- Cumulative GPA $\geq 2.2$
- Semester GPA $\geq 2.0$
- GPA $\geq 2.2$ 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 $\geq 2.0$
- Cumulative GPA $\geq 2.0$
- Semester GPA $\geq 2.0$ in core courses, design courses, Major-approved electives, and engineering distribution courses.
- At most one grade below C– in required core courses, design courses, Major-approved electives, and engineering distribution courses.
- 12 credits hours each semester
- No failing grades

Computer Science
- Semester GPA $\geq 2.3$
- Semester GPA $\geq 2.5$ 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
Electrical and Computer Engineering

- Semester GPA ≥ 2.3
- No course with a grade less than C– may be used to satisfy degree requirements in the Major program or serve as a prerequisite for a subsequent ECE course.
- Students must satisfactorily complete the following requirements: (a) two of the following courses: 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.

Engineering Physics

- Semester GPA ≥ 2.3
- At least a grade of C– in all required courses
- No failing grades

Environmental Engineering

(For all Environmental Engineering Majors regardless of what college they are enrolled in)

- Semester GPA ≥ 2.0
- Cumulative GPA ≥ 2.0
- Semester GPA ≥ 2.0 in core courses, design courses, Major-approved electives, and engineering distribution courses.
- At most one grade below C– in required core courses, design courses, Major-approved electives, and engineering distribution courses.
- 12 credits hours each semester
- No failing grades

Independent Major

- A passing grade in at least 12 credits each semester
- No more than one grade below C– in required Independent Major or Minor courses during the undergraduate program
- Semester GPA ≥ 2.0
- Cumulative GPA ≥ 2.0
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 a grade of C– in ENGRD 2110, ENGRD 2700, and all courses used toward the ISST Major. Note: For each of these courses, at least a grade of C– is required for the course to count toward the ISST Major graduation requirements. If a student receives a lower grade, then 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
- Not more than one grade as low as C– in the Major curriculum (Major required courses, materials electives, materials applications electives, and the outside technical elective)

Mechanical Engineering

- A passing grade in at least 12 credits each semester, with the exception of the final semester.
- Cumulative GPA ≥2.0.
- At least a grade of C– in all ME Major required courses used to satisfy the Major program except MAE 3780, ENGRD 2100, 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 a grade of C– in ENGRD 2110, ENGRD 2700, and all required Operations Research and Engineering Major courses
- Satisfactory progress (a minimum of 12 credits per semester)
- No failing grades

Science of Earth Systems

- Cumulative and semester GPA ≥2.0
- At least a grade of C– in all required courses
Academic Actions

At the end of each semester, the records of all students who have not yet affiliated with a Major are reviewed by the faculty committee on Academic Standards, Petitions, and Credit (ASPAC), and the records of students who have joined a Major are reviewed by faculty committees in those areas. Students who fail to meet the conditions for good standing may receive written warnings, may be required to take a leave of absence, or may be withdrawn from the college.

A warning should be taken very seriously. A student who receives a warning and continues to perform unsatisfactorily, may be dropped from the degree program. Poor performance also diminishes a student’s prospects for employment or graduate school. 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 a technical subject in 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. It will result in a postponement of graduation, but it can be regarded as an opportunity to address academic deficiencies before rejoining the engineering degree program. Students on a required leave of absence are not usually permitted to enroll in courses at Cornell, and they may choose to go to other institutions to retake the courses that caused them difficulty. After a required leave of absence, students are allowed to return to the engineering program but are required to repeat the courses that were not satisfactorily completed before their leave—courses taken elsewhere are not counted toward graduation unless permission is granted by ASPAC (or the Major, for affiliated students). Any exceptions to these rules must be requested in writing to ASPAC (or, for affiliated students, to the undergraduate consultant of their Major).

Occasionally, the faculty committee decides that a student is having such basic academic problems that they should leave the engineering program. This action is generally permanent. Students in this situation may wish to investigate other Majors at Cornell—Cornell Career Services in Barnes Hall is an excellent resource, as is the Internal Transfer Division in Day Hall. Students who want to continue their study of engineering are advised to seek admission to a different college or university.

Academic Integrity

The Cornell University Academic Integrity Handbook is distributed to new and transfer students and is available on the web at theuniversityfaculty.cornell.edu/pdfs/AcadIntegHdbk9.06Rev.pdf. 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, and is available on the web at http://cuinfo.cornell.edu/Academic/AIC.html.

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.

Class Ranking
Each summer the engineering registrar ranks the engineering students by ranking class (i.e. third-year, fourth-year). This takes into account all degree-applicable grades received for enrolled students up to the time of the ranking. Fourth-year students graduating in May are ranked immediately after graduation. Changes in grades made after ranking is completed do not affect the class rank of other students.

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 2008–2009, the requirement is a semester GPA $\geq 3.40$ (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 receive certificates from the Engineering Registrar’s office, and the honor is 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 $\geq 3.50$. Cum laude is also awarded to all engineering students who received a semester GPA $\geq 3.50$ 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 $\geq 3.50$ 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 $\geq 3.75$ (based on all credits taken at Cornell).

Summa cum laude is awarded to all engineering students with a GPA $\geq 4.0$ (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 a student graduate with the additional notation of “With Honors” on their diploma and transcript.

Biological Engineering (BE) Honors Program

To participate in this Major’s 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. 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 4991: Honors Research, to be completed in their fourth year. A written senior honors thesis must be submitted as part of this component. A minimum grade of A– is required for successful completion of the honors requirement.

- A significant teaching experience under the direct supervision of a faculty member or as part of a regularly recognized course in the department (i.e., BEE 1510, 2510, or 2600) under BEE 4980: Undergraduate Teaching.

- Advanced or graduate courses. These additional courses must be technical in nature (i.e. in engineering, mathematics, biology, chemistry, and physics at the 4000 and graduate level).

Timing

Complete a written application (available in 207 Riley-Robb Hall) 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
Each applicant must have a BEE faculty advisor to supervise the honors program. A written approval of the faculty member who will direct the research is required. After the college verifies the student’s GPA, the student will be officially enrolled in the honors program.

Civil Engineering (CE) Honors Program
To participate in this Major’s 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 or as part of 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
Interested 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
A CE faculty advisor or faculty member must supervise each applicant’s individual program. (This need not be the student’s faculty advisor.) The application to the program shall be a registration form for CEE 4000 and a letter from the student describing the specific proposed honors program and include the explicit approval of both the faculty advisor and honors advisor. Each program must be approved by the CE 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 Major’s Honors Program, students must meet the Major Honors Programs criteria as delineated on pages 154–157 and:

- At least one CS course (3-credit minimum) at or above the 5000-level with at least a grade of 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 a grade of A– each semester.

Content

Honors courses may not be used to satisfy the CS electives, the CS project course, the mathematics elective, the technical electives, courses in the specialization, or advisor-approved electives. In essence, honors course work represents a depth of work that is well beyond the minimum requirements needed to fulfill the Major.

Timing

To be considered for CS honors, candidates are required to send e-mail 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.

Preparation

Arrangements for doing 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.

The department reserves the right to make changes to the honors program at any time.

Electrical and Computer Engineering (ECE) Honors Program

To participate in this Major’s Honors Program, students must meet the Major Honors Programs criteria as delineated on pages 154–157 and:

- Apply during the first three weeks of the sixth semester.
- Have at least 139 credit hours for graduation, which includes the basic ECE degree requirements as well as Honors Program courses (9 credit hours).
- Achieve at least a grade of B in the three required courses.
- Enroll in ECE 3110: Electrical and Computer Engineering Honors Seminar during the third year for 2 credits and a letter grade.
- Complete a fourth-year Honors Project (3 credit hours minimum). This project can include research or directed reading, at the 4000 level, with an ECE faculty member.
- Earn at least 3 additional credit hours of advanced ECE course work. This course must have at least a 3000-level ECE course prerequisite.
Engineering Physics (EP) Honors Program

To participate in this Major’s Honors Program, students must meet the Major Honors Programs criteria as delineated on pages 154–157 and:

- Complete at least 8 credits of Major-approved electives at the 400 level or higher with at least a grade of A– in each course. These 8 credits are in addition to the credits obtained by completing the senior thesis or special project requirement as discussed in the next item.

- Enroll in AEP 4900: Independent Study in Engineering Physics or an equivalent course 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 2 credits in the first semester and 4 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.

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 4900, or the equivalent, the honors candidate must submit to the associate 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

Students interested in pursuing an honors program should contact the Undergraduate Program Director of Biological Engineering or the Associate Director of Civil and Environmental Engineering for information on the program requirements.
Independent Major (IM) Honors Program

To participate in this Major’s Honors Program, students must meet the Major Honors Programs criteria as delineated on pages 154–157 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 Major advisor.
- Have a written proposal of the honors project accepted by the Major advisor and the Independents 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 Major’s Honors Program, students must meet the Major Honors Programs criteria as delineated on pages 154–157 and:

- Three credit hours of ISST graded course work at least at the 5000-level (no S/U courses; no 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 grade of A– in each semester

or

- Three credit hours of INFO 4900 with an ISST faculty member and three 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.

Materials Science and Engineering (MSE) Honors Program

To participate in this Major’s Honors Program, students must meet the Major Honors Programs criteria as delineated on pages 154–157 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.
- Write a senior honors thesis (8 credits) with at least a grade of A.
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

A faculty advisor must supervise the honors program of each applicant. Written approval by the faculty member who will direct the research is required.

Operations Research and Engineering (OR&E) Honors Program

To participate in this Major’s Honors Program, students must meet the Major Honors Programs criteria as delineated on pages 154–157. An honors program shall consist of at least 9 credits beyond the minimum required for graduation in OR&E, 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 four hours 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 but it is better to make arrangements with a faculty member 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 Honors Program

To participate in this Major’s Honors Program, students must meet the Major Honors Programs criteria as delineated on pages 154–157 and:

- At least 9 credits above the minimum required for graduating and approved by the Major advisor;
- Have a written proposal of the honors project accepted by their faculty advisor and the director of undergraduate studies;
- Complete an honors thesis (EAS 4910–4920 or 4990, at least 2 credits each) involving research of breadth, depth, and quality.

Timing

A written proposal of the honors project must have been accepted by a student’s advisor and the director of undergraduate studies by the beginning of the seventh semester.

Procedures

A faculty advisor must supervise the honors program of each applicant. 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 action on academic matters that are not routine. The petition form, which may be obtained in Engineering Advising or online at www.engineering.cornell.edu/student-services/registrar/forms/index.cfm; is used to notify the petitioner, the registrar, and the faculty advisor.

Petitions are required for such purposes as:

- amending a program of study by adding courses after the first three weeks of the semester or dropping courses after the first seven weeks;
- amending 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.

The petition should include convincing evidence that an exception is warranted. A clearly stated petition has a better chance of approval than a poorly prepared one.

Students not yet affiliated with a Major should submit their petition to Engineering Advising. Affiliated students should check with their Major to determine where to submit their petition.

Leave of Absence
Students sometimes find it necessary to suspend their studies for a while. To do this, they must request a voluntary leave of absence in writing for a specified period of time and receive written approval.

Affiliated students request a voluntary leave through their Major. Unaffiliated students request a voluntary leave through Engineering Advising; the first step is an interview to establish conditions for the leave and subsequent return. Those who take a voluntary leave before affiliating with a Major and while not in good standing may be given a “conditional leave.” This requires them to meet specific conditions, established at the time the leave is granted, before they will be reinstated.

Students needing to take a medical leave of absence based on medical or psychological issues must initiate this leave with Gannett Health Services. The medical leave policy can be found at www.gannett.cornell.edu/MLOA.html.

Leaves of absence last for at least six months and are not generally granted for more than two years. A leave of absence granted during a semester goes into effect on the day it is requested. Students are responsible for any outstanding tuition or other university charges owed through that date. Leaves granted after the twelfth week of a semester generally result in withdrawal from all course work (i.e., a “W” will appear next to each course on the transcript). Students who owe money to the university are ineligible for leaves of absence. Courses taken during a leave are to satisfy Cornell degree requirements, and must be approved in advance through a formal transfer petition. No more than 18 transfer credits may be used to meet degree requirements after matriculation.
Students who intend to take a leave of absence should check with the Office of Financial Aid and Student Employment to find out about financial implications. This is especially important if they have taken out educational loans. Eligibility for medical insurance may also be affected.

**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 may not take Cornell extramural courses. Exceptions are granted only in extraordinary circumstances with the permission from Engineering Advising.

In the College of Engineering, credits earned in extramural courses are counted as transfer credits. Summer-session courses taken at Cornell are not considered for transfer credit (see section on transfer credit (pages 148–153) 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.

**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 contact 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.

Students who withdraw from the College of Engineering are eligible to apply for admission to one of the other six undergraduate colleges at Cornell. The intra-university transfer process should be followed.

Students who have withdrawn but wish to return must make a formal application 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.

**Rejoining the College After a Leave of Absence**

To return after a leave of absence, the conditions established when the leave was granted must be satisfied and the college must be notified.
Students who wish to rejoin the college and have not yet affiliated with a Major should request permission to rejoin in a letter to Engineering Advising. This must be done at least six weeks before the beginning of the semester in which the student wishes to return. The letter should describe the student’s activities while away from Cornell, detail any academic work completed during this time, and specify the courses the student intends to take when he/she returns. If permission to rejoin is granted, Engineering Advising will respond directly to the student. When a student rejoins the college, (s)he must see the faculty advisor to finalize course selection and should plan to return at least three working days before the beginning of classes. A call to set up an appointment is a good idea.

Unaffiliated students who rejoin after a required leave of absence are not permitted to have advanced beyond the level at which they left Cornell. For example, a student who failed PHYS 1112 in his/her last semester at Cornell may receive credit for a similar course taken elsewhere, but not for the equivalent of PHYS 2213. (An exception to this policy may be granted via petition, but permission should be secured before taking the course in question.)

Affiliated students should apply to their Major for permission to rejoin the college. 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.

Transferring from One Engineering Major to Another

Students who have affiliated with a Major program sometimes want to transfer to a different Major. Other possible candidates for transfer are students who have been notified that they have been withdrawn from their Major (and, therefore, from the college). Such students may still be eligible to apply to another Major. Contact Engineering Advising for more information.

Students who transfer from outside Cornell into the College of Engineering are affiliated with a specified Major when they are admitted and are not usually eligible to transfer to another Major for a period of one year. Therefore, transfer students who want to change Majors may find it necessary to take a leave of absence or to delay graduation.

To apply for transfer to another engineering Major, students must complete a Change of Major and/or Advisor form, which is available through Engineering Advising (167 Olin Hall) or any Engineering undergraduate Major office. Students must have permission from the intended Major to transfer; Majors are under no obligation to accept students who have already begun the fifth semester with a different affiliation.
Transferring to Another College at Cornell

Students sometimes come to the conclusion that they no longer wish to remain in the College of Engineering. When this happens, it is necessary for them to reevaluate their goals and motivations. Help is available from the student’s faculty advisor, Engineering Advising, and Cornell Career Services in Barnes Hall.

Students interested in transferring within Cornell should consult with Vivian Geller of the Internal Transfer Division, 220 Day Hall. Ms. Geller can provide expert counseling on the transfer process and information about each of the Cornell colleges to help students pinpoint their interests. (Students planning to transfer within Cornell should make an appointment to see Ms. Geller as early in the semester as possible.)

Students with satisfactory academic records may apply to the target college and, if accepted, transfer directly. Students who do not have strong academic records and those who have not taken courses in their target college should apply for registration in the Internal Transfer Division. This arrangement gives students the opportunity to demonstrate their abilities in the subjects they would be studying in the target college.

Procedures for Direct Intra-University Transfer

Students wishing to transfer to another undergraduate division within Cornell should visit the Internal Transfer Division office (220 Day Hall) and complete an application for transfer form. Completing this form prompts the Engineering Registrar to forward the following materials to the target college:

- Student’s original application to Cornell University
- High school transcript
- SAT scores
- Transcripts of college-level study completed at other institutions
- Transcript of Cornell course work

The College of Engineering retains any materials (such as petitions) that are not needed by the target college. Students who wish to have other portions of their records forwarded to the target college should submit a written request at the time they complete the transfer application form.

Admissions decisions are generally made at the end of each semester after final grades are available, and students are notified shortly thereafter.

Transferring with the Assistance of the Internal Transfer Division (220 Day Hall)

Students who are not in a position to transfer directly between colleges must apply to the Internal Transfer Division (ITD). This involves writing an essay explaining the reasons for the desired transfer, having an interview with the Internal Transfer Division director, and submitting an application for transfer form to the Engineering Registrar’s office. Students applying to the ITD must also fulfill the application requirements (e.g., interviews, essays) of their target college, as if they were applying for admission.
for direct transfer. Students can apply for direct transfer and to ITD simultaneously so that if direct transfer is denied, they might be offered the option of admission to ITD. The application process must be completed by the last week of classes of the semester before the one in which it is to take effect.

While in the Internal Transfer Division, students are usually “sponsored” by the college into which they wish to transfer. This means that the college agrees to accept them after successful completion of one semester of specified courses.

Students from the College of Engineering who register in the Internal Transfer Division may return to engineering under the following circumstances:

- A student who was in good standing when transferred to the Internal Transfer Division is allowed to compete with other internal transfer applicants for available space in the College of Engineering.
- A student who was in good standing but has taken no engineering courses in the Internal Transfer Division may apply to be sponsored by the College of Engineering.

**Change of Name or Address**

All students must keep the college advised of changes in their name or address. 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.

Students can update their addresses and phone numbers themselves (online) through Bear Access 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.) Changes of name or social security number should be submitted in writing to the University Registrar’s office.
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, whether seeking employment or pursuing appropriate advanced study.

In addition to career development, students should consider the many aspects of professional and personal development. It is recommended that students begin early to connect with professional and technical societies that can provide a network for the future. During the undergraduate years, participation in student professional and technical societies provides preparation for this next move. Obtaining legal recognition of commitment to the engineering field is also important. Students are encouraged to take the first steps toward professional engineering licensure during the fourth year by taking the Fundamentals of Engineering exam (apply by April of the third year for the October exam in fourth year).

Career and professional development decisions 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—especially in the fourth year. It is recommended that students plan, since this process can take much time and effort. The following resources can help.

ENGRG 2350: Career Development for Engineering
During the spring semester, undergraduates may enroll in this 2-credit course, team-taught by Cornell Career Services staff and faculty members. Topics include presentations and small-group discussions on career decision-making, values, skills, and interests, as well as résumés, cover letters, interviews, networking, and the job-search process.

Career Services at Cornell
Engineering Cooperative Education and Career Services
201 Carpenter Hall, 255.5006
www.engineering.cornell.edu/careerservices

The Engineering Cooperative Education and Career Services 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 200+ employers to campus to conduct more than 6,000+ interviews with engineering
students for full-time entry-level, co-op, and summer positions. Additionally, and in conjunction with Cornell Career Services, an extensive list of electronic job postings is maintained. See the web site www.career.cornell.edu.

The office coordinates seminars on job search and résumé/interview preparation; counselors are available to discuss career-related issues individually and in group settings. Students are encouraged to use these services in preparing for success in the job market.

**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 the engineering profession. 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 134–139) 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 Major 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 and applying to graduate and professional school.

- **Job search strategies**—job search seminars, employment career fairs, company information sessions, and on-campus interviews. A Career Guide manual provides sample résumés, cover letters, and advice on the job-search process. The on-campus recruiting program brings to campus more than 180 employers who conduct interviews for positions in the management consulting, financial services, retail, health care, and insurance industries.

- **Employment information via the Internet**—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. A credentials service allows students and alumni to maintain confidential files of recommendation letters and personal data to be used in securing employment or in applying to graduate or professional school.

Cornell Career Services’ web page www.career.cornell.edu provides a calendar of events, 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.

Graduate Programs in Engineering at Cornell

Information about graduate programs in the College of Engineering at Cornell is available at the Graduate Field Office of each school or department and from their web sites. Further information on graduate studies at Cornell can be found at www.engineering.cornell.edu/academic.

Three graduate degrees are available in the College of Engineering: Master of Science (M.S.), Master of Engineering (M.Eng.), and Doctor of Philosophy (Ph.D.).

Application Process

Students interested in graduate study in the College of Engineering choose a field of study and apply for admission through the Cornell Graduate School, which will refer the application to the field. For detailed information on graduate programs, requirements, application process, and contacts, please refer to the following Graduate School admissions web site: www.gradschool.cornell.edu/index.php?p=102.

The M.S. and Ph.D. Degree Programs

The M.S./Ph.D. degree programs offer rich opportunities to investigate scientific phenomena in depth and to make translations into technologies. Cornell has extensive and deep strengths in a number of disciplines and Cornell’s world-renowned faculty is responsible for many key scientific and engineering breakthroughs. Faculty members engage in many research projects with federal, state, and corporate sponsors, which make it possible for students to choose thesis research from a wide variety of topics. Research activities at Cornell are supported by more than 30 government, corporate, and university-sponsored interdisciplinary research centers, programs, and facilities—including three NSF nanotechnology centers, an NSF center in advanced materials, and a supercomputing center. Students also have
unique opportunities to enrich their experiences outside of Ithaca, for example in biomedical engineering through collaborations with the Cornell Weill Medical College and in financial engineering through the Wall Street office of the School of Operations Research and Information Engineering.

Students in good standing in the M.S./Ph.D. programs generally receive full support during their graduate studies, which covers tuition, health insurance, plus a stipend for both the academic year and the summer. Support may be in the form of fellowships, teaching assistantships, or research assistantships.

The Master of Engineering Program

The Master of Engineering (M.Eng.) degree features intensive, one-year professional programs of study built around core courses and a project, which offer students advanced training in science, current technology, and engineering design. M.Eng. programs are offered in 15 Major fields of study:

- Aerospace Engineering
- Biological and Environmental Engineering
- Biomedical Engineering
- Chemical Engineering
- Civil and Environmental Engineering
- Computer Science
- Electrical and Computer Engineering
- Engineering Management
- Engineering Mechanics
- Engineering Physics
- Geological Sciences
- Materials Science and Engineering
- Mechanical Engineering
- Operations Research and Information Engineering
- Systems Engineering

The M.Eng. Major fields are highly interdisciplinary in nature and afford a great deal of flexibility in tailoring a program to fit individual needs and interests. In addition, Minors are available in bioengineering, engineering management, manufacturing, and systems engineering.

Many M.Eng. programs offer opportunities for students to gain industry experience through collaborative partnerships. In addition, M.Eng. students can gain hands-on experience working collaboratively with other engineering fields and sometimes other colleges at Cornell on special project teams in national and international competitions. For qualified students, it is possible to earn an M.Eng. and an M.B.A. degree from Cornell’s Johnson Graduate School of Management in two years.
Typical M.Eng. graduates enter the work force with greater opportunities and at significantly higher salaries than those entering with a B.S. degree, and many are offered earlier chances of advancement.

The M.Eng. Early Decision Option

Highly qualified engineering students may apply to the M.Eng. program at the beginning of their fourth year with a request for an early decision. This relatively informal application process is usually done in October for the following fall semester and applicants are notified of admission and awards (if information is available) in December. The early decision option may help fourth-year students with decision-making as they near the completion of the B.S. degree. Information on Early Decision is available through the Graduate Field Offices.

The M.Eng. Early Admission Option

Students with at most 8 credits to earn toward their undergraduate degree in the last semester of their undergraduate program may apply. Accepted students may then begin work on their M.Eng. degree while completing the requirements of their undergraduate degree. Applicants must have an undergraduate GPA of $\geq 2.7$ at the time of application and must submit an “Early Admission Petition and Course Record Form” with their application. The form, which must be approved by both the student’s Major advisor and the Undergraduate College Registrar, must show the student’s course and time plan for completing both undergraduate and graduate degree requirements. The student must complete all requirements for the B.S. degree before enrolling as a graduate student in the M.Eng. program and the student must be enrolled in the Graduate School as a full-time M.Eng. student for a minimum of one semester. The form for Early Admission is available in all Graduate Field Offices and at the Office of Research and Graduate Studies, 222 Carpenter Hall.

National GEM Consortium

The university participates in the National GEM Consortium, which provides financial assistance and academic support for underrepresented minority students at the master’s and Ph.D. level. Graduate fellowships include tuition, a summer internship with pay, and an academic year stipend.

Students may apply during their third or fourth year. Applications must be completed online at www.gemfellowship.org by November 1. Fellowship awards are announced by February 1. Additional information may be obtained in the Diversity Programs in Engineering office, 146 Olin Hall.

Professional Development and Lifelong Learning

Professional and technical societies provide lifelong connections with colleagues and with the wider developments of the engineering profession and technology. Students are encouraged to join the student branches of these societies while undergrads and to seek full professional membership as graduation approaches. (A list of Engineering undergraduate student organizations can be found on page 183.)
Professional Engineer Licensing

Legal recognition of qualification to practice engineering is obtained through the licensing process. 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. However, obtaining the P.E. license is a multistate process that has a common first step across the nation 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 the first exam, engineers must complete several years of practice with increasing responsibility to later qualify for the P.E. exam in the state(s) of their choice. Passing the P.E. exam gives an engineer full legal right to public practice. For most employment of engineers, the P.E. license is not required; however, the P.E. license provides mobility to private or consulting-firm employment that would not otherwise be available.

To obtain the Professional Engineer (P.E.) license, a candidate must pass an Intern Engineer Examination, Fundamentals of Engineering, have a prescribed amount of experience in engineering practice, and pass the Professional Engineer Examination. Licensing for the P.E. is by individual state agency for the state in which the student wishes to practice. In New York, it is the New York State Board for Engineering and Land Surveying. Applications and other details are available from

Engineering Unit
Division of Professional Licensing Services
State Education Department
Cultural Education Center
Albany, NY 12230
Telephone: 518.474.3846

Applications and informational brochures are available in 167 Olin Hall. Fourth-year students graduating in May are eligible to take the Fundamentals of Engineering exam in April. When students complete an application, the college forwards it to Albany, certifying that they are “within 20 credits of graduation from an accredited engineering curriculum.” The examinations are given in various locations throughout the state. Syracuse is the test location closest to Ithaca. Applications must be sent to Albany at least 60 days before the examination. Thus, the filing deadline for the April examination is early February. To meet this deadline, students are urged to begin preparing their materials in December.
Engineering Awards

Several awards are offered to engineering students. Some require submitting a paper, and others are awarded in recognition of merit. The following are the principal awards:

The ABB Lummus Global Essay Awards
An annual prize of $1,000 divided among first-, second-, and third-place technical essays written by chemical engineering students. Students may select their own topics. Essays are typically due in April.

The American Institute of Chemical Engineers’ Donald F. Othmer Sophomore Academic Excellence Award
Award presented to the junior in chemical engineering who has the best academic record upon completion of the sophomore year.

The American Institute of Chemists Award
Presented to a senior in chemical engineering who has a record of leadership, ability, character, and scholastic achievement.

The ASCE John P. Riley ’22 Award
A first-year membership in the American Society of Civil Engineers (ASCE), presented to a member of the graduating class in Civil and Environmental Engineering who is a member of the student chapter of ASCE and has rendered meritorious service and special leadership to fellow students and to the Civil Engineering profession.

The ASCE Student Service Award
Presented to a member of the graduating class in Civil and Environmental Engineering who is a member of the student chapter of ASCE and has rendered the most meritorious service to fellow students and to the profession of Civil Engineering.

The ASCE Winslow T. Shearman (Student Merit) Award
Presented to a member of the graduating class in Civil and Environmental Engineering who is an active member of the student chapter of the American Society of Civil Engineers and is considered most worthy of the honor by virtue of high character and academic achievement.

The Roger K. Berman ’70 Memorial Prize
A cash award given annually for excellent oral presentation in an engineering communications course, typically given to eight students and carrying a cash award of $150 each.

The R. Bolgiano, Sr. Outstanding Teaching Assistant Award
Presented to the teaching assistant in the Sibley School of Mechanical and Aerospace Engineering who is judged most outstanding. Selection is based mainly on recommendations of faculty members, student comments, and other relevant information. Presented in May at the Sibley Commencement ceremony.

The Chester Buchanan Memorial Award
A prize of $1,000 awarded each spring to “that outstanding senior majoring in Science of Earth Systems that is recommended by the faculty of the Department of Earth and Atmospheric Sciences.”
The Lynn Bussey Prize
Awarded at commencement to an outstanding student in OR&E who is continuing in the Master of Engineering Program.

The Dorothy and Fred Chau Award
An award of $1,200 is provided—in general annually—to a senior in engineering physics in high academic standing who has performed outstanding, publishable research in engineering physics or related Majors. The award includes travel support of up to $500 to present the work at a relevant scientific conference and an award of $500 to the faculty member or senior researcher guiding the student’s research. The student is expected to present his/her work to the students and faculty of the School of Applied and Engineering Physics.

The David Delano Clark Award
A $1,000 cash prize awarded annually for the best Master of Engineering project.

The Clark Construction Group, LLC Prize
An award of $4,000 given to a junior in Civil and Environmental Engineering with an interest in construction management for academic merit, leadership, and extracurricular activities.

The Computer Science Prize for Academic Excellence
An award of $500 and a commemorative plaque in recognition of a senior in the Major of computer science who has performed exceptionally well academically and who has shown strong commitment to the ideals of the educational mission at Cornell. Special consideration is given to students who have displayed an interest in research and who plan eventually to pursue doctoral-level studies. This award represents the highest honor given to an undergraduate by the Department of Computer Science.

The Bart Conta Prize in Energy and the Environment
The Bart Conta Prize is awarded annually to one or more undergraduate or master of engineering students in the Sibley School of Mechanical and Aerospace Engineering. The award is made to the student or students who have done the best work on a research or design project dealing with energy and the environment. The recipient(s) of the prize are selected by a faculty committee, based on a review of project summaries presented to the committee. The prize is presented at the Sibley School commencement ceremonies in May.

The Margaret Arronet Corbin ‘21 Prize
An award of approximately $4,000 presented to a graduate in Civil and Environmental Engineering who has combined academic excellence with meritorious activities and service in the Cornell community and who demonstrates a commitment to continue his/her education in Civil and Environmental Engineering.

The Charles Lee Crandall Prizes
Annual prizes of $1,000 and $500 for the best papers written by students in the School of Civil and Environmental Engineering. Papers are judged in three categories: civil infrastructure, environment, and systems engineering and information technology.

The T. R. Cuykendall Awards
A prize of $300 awarded each spring to the outstanding member of the senior class in engineering physics, and a prize of $300 awarded to the outstanding teaching assistant of undergraduate engineering physics courses.

The LTC John B. Davenport Award
An annual award to an engineering student who is a member of the Army ROTC. Established in 1980 by Mrs. Elizabeth Hennessey in honor of her late husband.

The John McMullen Dean’s Prizes
Entering first-year students are selected, on the basis of merit, as John McMullen Dean’s Scholars. Prizes are awarded within the context of the university’s financial-aid program and renewed if the recipient remains in good standing in the College of Engineering.

William S. Einwechter Award
Presented to an outstanding senior who has demonstrated a distinguished record
of service to the School of Electrical and Computer Engineering (particularly its students), to the College of Engineering, and to the university while maintaining good academic performance.

The Nanotechnology Fellowship
Approximately $500 awarded to a junior or senior Materials Science and Engineering student involved in research.

The Frank O. Ellenwood Prize
Given to the student in the Sibley School of Mechanical and Aerospace Engineering who ranks highest in the third-year required courses related to power engineering. Presented in May at the Sibley Commencement ceremony.

The William Nichols Findley Award
A $500 cash prize awarded annually for an outstanding research paper by a graduate student in Applied Physics.

The Fuertes Medal
A gold medal awarded to the graduating senior in Civil and Environmental Engineering who has maintained the highest degree of scholarship in his/her study during four consecutive years.

The Samuel Garmezy ’13 Prize
An annual prize for winning a competition using the Samuel Garmezy testing machine in the School of Civil and Environmental Engineering. Established by Robert H. Garmezy ’44 in honor of his late father.

The Paul Hartman Prize
Given each spring to the physics or engineering physics senior that has done the most outstanding work in experimental physics during their Cornell career.

The R. N. Janeway Automotive Engineering Award
Given to juniors and seniors and graduate students in the Sibley School of Mechanical and Aerospace Engineering and Electrical Engineering for the paper or papers that present the most promising improvement in automotive vehicles. Presented in May at the Sibley Commencement ceremony.

The Joseph O. Jeffries Prize
Awarded to a senior in Materials Science and Engineering for the most outstanding materials design project.

The Thomas J. and Jean T. Kelly Prize
Given to seniors in the Sibley School of Mechanical and Aerospace Engineering who demonstrate excellence in aerospace engineering through course work or an innovative design project. Awardees must show tangible evidence of being a well-rounded person with an outstanding contribution to Cornell and/or the greater community.

Alan S. Marx Memorial Prize for Excellence in Support of Undergraduate Education
Given to a graduating senior who has demonstrated excellence in, and exceptional commitment to, the support of undergraduate teaching activities in the Department of Computer Science. The winner receives a check for $500 and is recognized with a commemorative plaque presented by the faculty on commencement day. The recipient is selected from the ranks of students who have served as course consultants, graders, or undergraduate teaching assistants.

The Jonathan E. Marx Cornell Tradition Fellowships
Two fellowships of $2,500 each are awarded annually to computer science students who hold jobs on campus to help pay for their education and who also have demonstrated a commitment to scholarship and leadership activities.

The Jonathan E. Marx Memorial Senior Prizes
Two $500 awards given to the two seniors in computer science who have a record of friendly and helpful attitudes, show leadership qualities, and have been involved in extracurricular activities.
The McManus Design Award
An annual prize is awarded to the Sibley School of Mechanical and Aerospace Engineering student or students, undergraduate or graduate, who present the most outstanding solution to a design problem or project. Presented in May at the Sibley Commencement ceremony.

The Merck Engineering and Technology Fellowship
Tuition support of $5,000 for two years and two summer internships at Merck to a chemical engineering sophomore. Chosen by Merck on the basis of scholarship and character from nominees submitted by the chemical engineering faculty.

The Merrill Presidential Scholars Award
Graduating seniors honored as Merrill Presidential Scholars serve as degree marshals and banner bearers at graduation convocation, and are also recognized at the Merrill Presidential Scholars luncheon, to which they may invite a teacher from their high school and an instructor from Cornell University who influenced their academic careers. This award is based on grade-point average and other indicators of excellence, including demonstrated leadership ability, community involvement, and potential for continued contributions to society.

The Michael W. Mitchell Memorial Award
A prize of $1,000 awarded each year to a senior in Science of Earth Systems who has proven adept at liberal arts as well as earth sciences—a “student of the world.”

The Mogensen Prize
Awarded at commencement to an outstanding student in OR&E who is continuing in the Master of Engineering Program.

The Moles Student Award
A $1,000 prize and award certificate is given to a graduating Civil and Environmental Engineering senior who is selected in recognition of high academic achievement, enthusiasm, and effort, and who shows outstanding promise for a career in construction engineering and management.

The Moles Scholarship
A $6,000 scholarship is given annually to a deserving and academically qualified senior studying Civil Engineering with high academic standings and expressed interest to pursue his/her career in the construction industry.

John E. Perry Undergraduate Prize
An award of $500 given to one or more graduating seniors in Civil and Environmental Engineering who demonstrate “enthusiastic participation in student life and commitment to the profession of engineering” as well as scholarship.

John E. Perry Teaching Assistant Prize
An award of $500 given to one or more teaching assistants in the School of Civil and Environmental Engineering who exhibit “concern and care for the students in their class and fulfill the teaching functions enthusiastically and skillfully.”

The Procter and Gamble Technical Excellence Award
An annual prize of $1,000 awarded to the senior in Chemical Engineering, Biological Engineering, or Mechanical Engineering who gives the best presentation on a technical problem solved by the student.

The Frank H. T. Rhodes Award
This prize, established in 2005 by the Andrew Allen Foundation in honor of Frank H. T. Rhodes, is presented each year to the senior in the Department of Earth and Atmospheric Sciences who has excelled academically.

The Ferdinand Rodriguez Outstanding Student Award in Polymers and Electronic Materials
An award of $3,500 to an undergraduate or M.Eng. student in Chemical Engineering for outstanding research in polymers or electronic materials. Sponsored by Rohm and Haas.
The Byron W. Saunders Prize
A cash award for the senior(s) graduating from the School of Operations Research and Information Engineering with the best academic record.

The George F. Scheele Outstanding Junior Award
An award of $3,500 given to a junior in chemical engineering who excels in scholarship, campus activities, and leadership. Sponsored by Genentech.

Hiram Sibley Prize
Presented annually by the School of Electrical and Computer Engineering to the senior with the highest combined average over all four years.

The Sibley Prizes
Two prizes awarded annually to seniors in the Sibley School of Mechanical and Aerospace Engineering who have the highest scholastic averages. Presented in May at the Sibley Commencement ceremony.

The Douglas Whitney ’61 Award
An annual award for excellent writing in an engineering communications course, typically given to one or two students and carrying a cash award of $1,000 or $500, respectively.

The Frank W. and Emily Wood Fund
This fund provides scholarship assistance to students who are planning to pursue studies at Imperial College of Science, Technology, and Medicine in London, U.K. Information is available from Cornell Abroad, 474 Uris Hall.

The Ve-Sing and Tseng Soo Koo Award
This prize, established in 1990 by Professor Benjamin Koo, Ph.D. ’46, consists of approximately $4,000 and an award certificate, which is awarded to an outstanding senior in structural engineering in Civil and Environmental Engineering who is planning to pursue graduate studies at Cornell.
Student Organizations

Student organizations at the College of Engineering help connect classroom and career, develop professionalism, increase technical proficiency, and refine ethical judgment. Some are involved in community service; many sponsor 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 at the Engineering Student Council web site, esc-cornell.org/index.asp.

Alpha Epsilon

c/o Professor Jim Bartsch
314 Riley-Robb Hall

Alpha Epsilon, the national honor society in agricultural, food, and biological engineering, is dedicated to providing service to the community at large and to promoting the welfare of the Major of agricultural, food, and biological engineering. The chapter organizes peer advising, class tutoring, fund-raisers, and social events. The Cornell chapter, founded in March 1998, recently won the Alpha Epsilon Outstanding Chapter award for its accomplishments.

Alpha Sigma Mu

c/o Professor Shefford Baker
129 Bard Hall

Alpha Sigma Mu is an honorary society for students in materials engineering. It recognizes outstanding students who attain a high rank in scholarship and possess, to an unusual degree, the qualities of integrity, leadership, and initiative.

American Association of Petroleum Geologists (AAPG)

c/o Professor Teresa Jordan
4108 Snee Hall

The American Association of Petroleum Geologists aims to familiarize students with major and professional opportunities in petroleum exploration and development. The organization strives to foster professional ethics, including honesty, integrity, loyalty, fairness, impartiality, candor, fidelity to trust, and inviolability of confidence among its members. Membership is open to undergraduate and graduate students interested in the petroleum industry.

American Indian Science and Engineering Society (AISES)

c/o Diversity Programs in Engineering Office
146 Olin Hall

The goal of AISES is to provide opportunities for American Indians and Alaskan Natives to pursue studies in science, engineering, business, and other academic areas. Members practice leadership skills, bring cultural programs to campus, and search for ways to improve the social and academic environment for Native Americans on campus.
American Institute of Aeronautics and Astronautics (AIAA)
108 Upson Hall
The student chapter of the American Institute of Aeronautics and Astronautics (AIAA) is open to everyone who is interested in atmospheric and space flight. The group arranges movies and field trips, as well as an annual student conference. Members receive Aerospace America, the official publication of the AIAA.

American Institute of Chemical Engineers (AIChE)
120 Olin Hall, aiche@cornell.edu
wwwcheme.cornell.edu/cheme/undergraduate/info/activities.cfm

The Cornell student chapter of the AIChE is composed of chemical engineering students at the undergraduate and graduate levels. The goals of the chapter are to promote the professional development of its members by its programs, its relations with other student chapters and its relations with the parent body, National AIChE; and to contribute to the development of chemical engineering at Cornell through activities involving faculty and students. Programs and activities include: professional workshops, group trips to the AIChE national and regional conferences, sponsorship of corporate visitors and company information sessions, engineering education and community outreach events, AIChE ChemE Car competition, professor–student lunches, bowling, poker tournaments, intramural sports games, movie nights, bi-weekly social gatherings, the annual welcome back barbecue, holiday party, and the senior award dinner.

American Society of Civil Engineers (ASCE)
c/o Professor Jery Stedinger
213 Hollister Hall
Cornell has one of the most active student chapters of the ASCE in the United States. Projects include the design and construction of community service projects, organization of preparatory courses for the Fundamentals of Engineering exam, and sponsorship of intramural teams. ASCE organizes social events, the annual CEE awards dinner, company information sessions, and monthly meetings featuring professional speakers. The chapter participates in regional and national ASCE conferences and competes in concrete canoe races and steel bridge competitions.

American Society of Mechanical Engineers (ASME)
108 Upson Hall
www.rso.cornell.edu/ASME/
The Cornell chapter of ASME is one of the strongest in its region. It has more than 150 active members and runs various activities for students and the local community. The group participates in a variety of intramural sports, hosts social events, cooks fantastic barbecues, holds monthly meetings and always welcomes new ideas for events. Membership is open to all undergraduates; affiliation with mechanical engineering is not required. First-year students may join national ASME for free.
Association of Computer Science Undergraduates (ACSU)

c/o Nicole Roy, 303 Upson Hall
acsu.cornell.edu

The purpose of the ACSU is to increase interaction between undergraduate computer science Majors, and the computer science faculty and to foster a friendly environment in CS. Membership is open to all Cornell undergraduates. The organization produces an exclusive résumé book for seniors seeking permanent employment as well as underclassmen who seek summer employment. Members are encouraged to join the ACM, which is the national professional organization for computer scientists and software developers.

Biological and Environmental Engineering Society

c/o Larry Geohring
212 Riley-Robb Hall

The Cornell student branch of the American Society of Agricultural and Biological Engineers (ASABE) is a group of undergraduate and graduate students in Biological and Environmental Engineering. As student members of ASABE (a large and international professional engineering society), members have access to scholarships, conferences, and opportunities for networking. The student group can organize and arrange invited speakers, field trips, participate in Engineering Day at the mall, get involved in community projects, and carry out other educational and social activities.

Biomedical Engineering Society

c/o Professor Michael Shuler
270 Olin Hall

The Cornell Chapter of the Biomedical Engineering Society (BMES) is affiliated with the national professional society. Our mission is to foster interest, knowledge, and education in biomedical engineering. The chapter welcomes undergraduate and graduate students from all engineering disciplines as well as those from the biological systems area. The group conducts tours, hosts guest lectures and social events, and organizes trips to the annual meeting of BMES, which has student activities, research presentations, and career development sessions. Opportunities to serve as chapter officers are open to all students.

Chi Epsilon

c/o Professor James M. Gossett
215 Hollister Hall

Chi Epsilon, the national honor society in Civil Engineering, is dedicated to maintaining and promoting the status of civil engineering. It fosters the development of technical ability and character among Civil Engineers. The chapter also seeks to promote and recognize excellence in teaching among the Civil Engineering faculty by conducting an annual CEE Instructor of the Year award. A
biennial national conclave offers members the opportunity to meet students from other schools and exchange ideas. The chapter actively supports the CEE school administration in other endeavors to improve the quality of Civil Engineering education at Cornell University.

**Cornell AEP Society (CAEPS)**

c/o Professor Chris Xu
212 Clark Hall

The CEPS was founded in 1990 by students in the School of Applied and Engineering Physics. Activities include seminars in applied science by various faculty members, lectures by visiting Cornell AEP alumni and AEP recruiters, career information sessions, outreach programs, and a variety of social events. Undergraduate and graduate students are welcome as members of CAEPS.

**Cornell Chapter of the American Meteorological Society (CCAMS)**

c/o Mark W. Wysocki
1114 Bradfield Hall

The CCAMS is open to all students interested in meteorology. The primary goals are to promote understanding of all aspects of meteorology, increase interaction between faculty members and students, and keep students current with the job market. The club organizes professional events such as forecasting workshops, technical seminars, job seminars, and group trips to the annual Northeast Storm Conference and social events such as bowling and pizza parties. The club also sponsors and maintains the “Weather Phone,” a daily forecast prepared by students for the Cornell community and residents of Tompkins County. Club members participate in local science fairs and attend the annual AMS National Convention.

**Cornell Materials Society (CMS)**

c/o Professor Michael Thompson
328 Bard Hall

The CMS represents the university’s undergraduate chapter of the Materials Research Society (MRS), The Materials Information Society (ASM), and The Minerals, Metals, and Materials Society (TMS). This student-run organization is devoted to the advancement of materials science by hosting events, information sessions, industrial involvement, outreach programs, and other social activities. All students are welcome especially MSE Majors and others with an interest in the fields of nanotechnology, biomedical engineering, semiconductors, and other materials.

**Digital Gaming Alliance (DGA)**

c/o Walker White
4122 Upson Hall

The DGA is a coalition of student organizations at Cornell interested in promoting a
community of gamers and game developers. DGA has its own elected officers and a full calendar of events.

**Encourage Young Engineering Students (EYES)**

Public Service Center  
200 Barnes Hall

EYES, a national community-service organization, is committed to increasing the mathematics and science skills of evolving elementary, middle, and high school students. EYES encourages local youth to succeed and achieve while raising educational standards and accomplishes its mission by tapping the wealth of talented undergraduate engineering students to deliver exciting activities to instill an interest in engineering disciplines.

**Engineering Ambassadors Association**

102 Hollister Hall  
www.ea.cornell.edu

The Engineering Ambassadors Association is a group of student volunteers who introduce prospective first-year students to the College of Engineering. They work closely with the Admissions Office staff. The ambassadors participate in group information sessions, lead tours of the engineering quad, and take visitors to lunch. They also participate in phonathons. More information can be found in Engineering Admissions, 102 Hollister Hall or at www.ea.cornell.edu.

**Engineering Representative to the Student Assembly**

Engineering Student Assembly  
Office of the Assemblies  
165 Day Hall

Each spring two representatives to the Student Assembly are elected from the College of Engineering. The Student Assembly meets every week on Thursdays, 4:45 to 6:30 p.m., to discuss and make decisions about issues concerning student life at Cornell, including housing and dining. Other functions pertain to setting the Student Activities Fee, disbursement of funds to student organizations, influencing general university policy, and communication with college and university administrators. All students are welcome to attend Student Assembly meetings and participate in the discussions. Agendas are available before meetings from the Office of the Assemblies, 165 Day Hall, or at assembly.cornell.edu/SA/home.

**Engineering Student Council (ESC)**

162 Olin Hall  
esc-cornell.org/index.asp

The goals of the college-wide ESC are to represent the interests of students in the college and university, promote and coordinate engineering student services and events, and provide leadership training for students and organizations. ESC activities
include National Engineers Week, the Engineering Spring Career Fair, and serving as the student voice to administration. General membership is open to all undergraduate and graduate students.

**Engineers for a Sustainable World (ESW)**

c/o Professor Park Doing  
396 Rhodes Hall  
www.rso.cornell.edu/esw

ESW is a national nonprofit organization with a network of engineering students and professionals working to reduce poverty and improve global sustainability. Cornell is home to the country’s first chapter of ESW. Members learn about and promote awareness of the technological needs of developing communities. Their activities include inviting guest speakers to discuss issues related to technology, development, and community service; coordinating and participating in volunteer service activities related to engineering; and interacting with other ESW chapters nationwide. They also assist in CEE 4920: Engineers for a Sustainable World: Engineering in International Development.

**Eta Kappa Nu (HKN)**

c/o Clifford Pollock  
224 Phillips Hall

HKN, the electrical and computer engineering honor society, promotes interaction between members and service to Cornell and the community at large. The Cornell chapter operates a tutoring program to assist others studying electrical engineering. It sponsors lectures by ECE professors on state-of-the-art research at Cornell. Election to HKN is a lifelong mark of distinction.

**Information Science Student Association (ISSA)**

c/o Christine Stenglein  
303 Upson Hall

The goals of the ISSA are: To connect Information Science (IS) and Information Science, Systems, and Technology (ISST) students with one another and with faculty through special events and activities; to serve as a bridge between current students and alumni; to provide students with information regarding career opportunities, internships, graduate schools, professional associations, and research opportunities in the field of information science and technology through web-based and print resources and information sessions; and to inform others, both inside and outside of Cornell, of the IS and ISST Majors.

**Institute of Biological Engineering (IBE)**

c/o Professors Dan Luo and Norm Scott  
226 and 216 Riley-Robb Hall

IBE has been established to encourage inquiry, application, and interest in biological
engineering in the broadest and most liberal manner and to promote the professional development of its members. Through its exclusive sponsorship of the Annual Bioengineering EXPO, IBE has established itself as the foremost organization for the promotion of biological engineering at Cornell. IBE is open to all members of the Cornell community with a genuine interest in biological engineering.

Institute of Electrical and Electronics Engineers (IEEE)

c/o John Belina
201 Phillips Hall

IEEE is one of the largest and most active professional organizations in the United States. Cornell’s student branch runs many programs to serve the electrical engineer. The group sponsors many activities to promote student-to-student and student-to-faculty interaction and sponsors company information sessions to provide an opportunity for students to meet corporate interviewers. IEEE runs a lecture series for students and organizes presentations on course selection.

Institute for Operations Research and the Management Sciences (INFORMS)

c/o Cindy Jay
203 Rhodes Hall

The Cornell chapter of INFORMS sponsors a broad program of activities, including group trips to manufacturing and consulting firms, programs in which professional people from industry discuss career opportunities, and social activities, including monthly informal faculty/student lunches.

Mu Sigma Tau

c/o Christa Downey
201 Carpenter Hall

Mu Sigma Tau is a co-op honor society reactivated in 1991 by Engineering Cooperative Education students. The group’s main duties are to promote the co-op program to prospective students, improve the quality of the co-op experience, provide a forum for sharing co-op experiences, keep alumni involved in co-op activities, and serve as a social network for all participants.

National Society of Black Engineers (NSBE)

c/o Diversity Programs in Engineering Office
146 Olin Hall

The Cornell University chapter of NSBE was formed in 1977. Major objectives include stimulation and development of student interest in the engineering disciplines; achievement of significant increases in the enrollment and retention of black students in engineering; and development of programs to strengthen the relationship between students and industry. Membership in NSBE–CU is open to all

Student Organizations
Cornell students who have or are working toward a degree in engineering or the sciences.

**Omega Rho International Honor Society**

c/o OR&E  
203 Rhodes Hall

The local chapter of the Omega Rho International Operations Research Honor Society was founded in 1995. It recognizes outstanding students who attain a high rank in scholarship in the School of Operations Research and Information Engineering. Students must be nominated by a faculty member and be in the top fourth of their class.

**Peer Advisor Program**

c/o Engineering Advising  
167 Olin Hall

The Peer Advisor Program is an organization of engineering second-, third-, and fourth-year students whose goals are to help first-year engineering students adjust to life at Cornell and in the College of Engineering, understand the course selection and registration processes, and meet other engineering students in an informal social setting. Two peer advisors who are assigned to each section of ENGRG 1050: Engineering Seminar serve as mentors for the approximately 18 students in the class.

**Pi Tau Sigma**

108 Upson Hall

The Cornell chapter of Pi Tau Sigma, the honorary society in mechanical engineering, provides a tutoring service for engineering students, organizes student/faculty luncheons and workshops, and generally seeks to enhance the academic and social aspects of the undergraduate ME program. To become candidates for membership, ME students must be in the top quarter of their junior class or the top third of their senior class.

**Society of Automotive Engineers (SAE)**

c/o Professor Albert George  
208 Upson Hall

Activities sponsored by SAE include orientation for those with little or no knowledge of automobiles, design, and construction of a Formula SAE racing car, and lectures on the state of the art in automotive engineering.

**Society of Hispanic Professional Engineers (SHPE)**

c/o Diversity Programs in Engineering Office  
146 Olin Hall

The goals of the Cornell chapter of SHPE are to advance Hispanic representation at
Cornell and to assist Hispanic students in fulfilling their academic obligations and planning professional careers. Workshops and seminars by faculty and corporate representatives are geared toward self-improvement in academia and the transition to the corporate world. Social activities such as picnics and barbecues, intramural athletics, and study breaks foster a fraternal spirit among engineers from diverse Latino backgrounds.

**Society of Women Engineers (SWE)**

c/o Diversity Programs in Engineering Office
146 Olin Hall

SWE is a national professional and educational service organization of women and men whose goals are to improve the status, training, and support of women engineers. Membership in Cornell SWE is open to undergraduate and graduate students in engineering physics, chemistry, and computer science. Activities fall into three categories: academic support, professional and career development, and pre-college education.

**Tau Beta Pi**

c/o John Belina
201 Phillips Hall

The Tau Beta Pi Association was founded in 1885 to honor outstanding students and alumni in all Majors of engineering. To be eligible for membership, students must be in the top eighth of their junior class or the top fifth of the senior class and display exemplary character. Cornell’s chapter of Tau Beta Pi sponsors a variety of programs including balloting for the college’s Excellence-in-Teaching Award each spring. There are social events for members and lectures on topics of interest to the Cornell community as well as projects of service to the Ithaca community.
A
AAPG. See American Association of Petroleum Geologists
ABBB Lummus Global Essay Awards, 178
ABET (Accreditation Board for Engineering and Technology). See inside front cover
Academic Excellence Workshops (AEWs), 31, 138
academic integrity, 158–59
Academic Integrity Hearing Board, 159
academic standing
  academic actions, 158
  class rank, 159
  Dean’s List, 159
  in engineering Major programs, 155–57
  general requirements for maintaining, 154
  graduating with distinction, 159–60
  and internal transfers, 171
  Major honors programs, 160–66
academic support services, 8. See also advising
Accelerated M.B.A. program, 138
accreditation, 135
Accreditation Board for Engineering and Technology (ABET). See inside front cover
ACSU. See Association of Computer Science Undergraduates
add/drop form, 141–42, 146
address, changing, 171
Advanced Placement credit
  in Biology, 109, 110
  for ChemE Majors, 46
  in Chemistry, 15
  information about, 153
  and international study, 136
  policies regarding, 148, 150
  pros and cons of, 148–49
  subjects and scores accepted, 149–50, 151
  using, 153
advising, 26, 29
advising, faculty, 2, 21, 26–28
  and course enrollment process, 142, 143
  for double Majors, 134
  grading option, 147
  in Independent Major program, 135
  internal transfers, 170
advising, peer, 28–29
  for developing leadership skills, 138
  Peer Advisor Program, 26, 190
  role of peer advisors, 22
AEM 2100: Introductory Statistics, 133
AEM 2200: Introduction to Business Management, 133
AEM 2210: Financial Accounting, 133
AEM 2400: Marketing, 133
AEM 3220: Internet Strategy, 77, 80, 126, 127
AEM 3230: Managerial Accounting, 133
AEM Undergraduate Program, 133
AEP 2520: The Physics of Life, 110
AEP 2640: Computer-Instrumentation Design, 16
AEP 3210: Mathematical Physics I, 64, 65, 66
AEP 3220: Mathematical Physics II, 64, 65, 66, 103, 104, 105
AEP 3300: Modern Experimental Optics, 65, 67
AEP 3330: Mechanics of Particles and Solid Bodies, 17, 64, 65, 66, 67, 104
AEP 3550: Intermediate Electromagnetism, 64, 65, 66
AEP 3560: Intermediate Electrodynamics, 64, 65, 66
AEP 3610: Introductory Quantum Mechanics, 64, 65, 66
AEP 3620: Intermediate Quantum Mechanics, 64, 65, 66
AEP 3630: Electronic Circuits (Laboratory), 64, 65, 66
AEP 4230: Statistical Thermodynamics, 64, 65, 66
AEP 4340: Continuum Physics (Laboratory), 64, 65, 66
AEP 4700: Biophysical Methods, 107, 110
AEP 4900: Independent Study in Engineering Physics, 163
Aeronautics and Astronautics, American Institute of (AIAA), 184
Aerospace Engineering (M.Eng.) program, 175
Aerospace Engineering Minor, 99, 101–2
Aerospace Engineering project teams, 23
AEWs. See Academic Excellence Workshops
Agriculture and Life Sciences, College of
  Biomedical Engineering Minor, 109
  Business for Engineering Students Minor, 100, 133, 135
  Department of Communication, 16
AguaClara Project, 23, 120
AIAA. See American Institute of Aeronautics and Astronautics
AIChE. See American Institute of Chemical Engineers
AISES. See American Indian Science and Engineering Society
Alan S. Marx Memorial Prize for Excellence in Support of Undergraduate Education, 180
A-Level examination, 148, 150, 151
Alpha Epsilon, 183
Alpha Sigma Mu, 183
alumni, 22–23, 25
Alumni Speakers Week, 22
AMBA (Accelerated M.B.A.) program, 138
Ambumedics (ECE project), 60
American Association of Petroleum Geologists (AAPG), 183
American Indian Science and Engineering Society (AISES), 23, 138, 183
American Institute of Aeronautics and Astronautics (AIAA), 184
American Institute of Chemical Engineers (AIChE), 184
American Institute of Chemical Engineers’ Donald F. Othmer Sophomore Academic Excellence Award, 178
American Institute of Chemists Award, 178
American Meteorological Society, Cornell Chapter of, 186
American Society of Agricultural and Biological Engineers (ASABE), 185
American Society of Civil Engineers (ASCE), 184
American Society of Mechanical Engineers (ASME), 184
AP credit. See Advanced Placement credit
Applied and Engineering Physics, School of, 64, 186
Applied Economics and Management, Department of, 100, 135
Applied Mathematics Minor, 99, 103–5
Applied Mechanics, Department of, 103
ARCH 3704: Introduction to Computer Graphics, 122
Architecture, Art, and Planning, College of, 134
ART 2703: Computer Animation, 123
Arts and Sciences, College of, 109, 134
ASABE. See American Society of Agricultural and Biological Engineers
ASCE. See American Society of Civil Engineers
ASCE Concrete Canoe Competition, 23
ASCE John P. Riley ’22 Award, 178
ASCE Marshall Case Haggard Award, 178
ASCE Student Service Award, 178
ASCE Winslow T. Shearman (Student Merit) Award, 178
ASM. See Materials Information Society
ASME. See American Society of Mechanical Engineers
Association of Computer Science Undergraduates (ACSU), 185
ASPAC. See Committee on Academic Standards, Petitions, and Credit
ASTRO 4410: Experimental Astronomy, 65
awards in engineering, 178–82

B
Bachelor of Arts, 134
Bachelor of Fine Arts, 134
Bachelor of Science, 13,
dual-degree programs, 134, 138–39
graduating with distinction, 159–60
graduating with honors, 160
graduation requirements, 14–20
and Minors in Engineering, 99
Bachelor of Science degree, requirements for, 13, 14–20
advice on, 27
listed, 13
responsibility for, 2
and ROTC courses, 144
Baker, Shefford (Professor) 12, 183
Bart Cona Prize in Energy and the Environment, 179
Bartsch, Jim (Professor), 183
BE. See Biological Engineering Major
Bear Access, 141, 171
BEE 1200: The BEE Experience, 38, 39, 40, 41, 68, 70, 72
BEE 1510: Introduction to Computing Using Java, 38, 39, 40, 70, 72, 73
BEE 2220: Bioengineering Thermodynamics and Kinetics, 38, 39, 40
BEE: 2510: Engineering for a Sustainable Society, 38, 39, 40, 120
BEE 2600: Principles of Biological Engineering, 38, 39, 40, 106
BEE 3050: Principles of Navigation, 144
BEE 3310: Bio-Fluid Mechanics, 38, 39, 40, 106
BEE 3500: Biological and Environmental Transport Processes, 38, 39, 40, 106
BEE 3600: Molecular and Cellular Bioengineering, 106, 107, 110
BEE 3650: Properties of Biological Materials, 107, 110
BEE 3710: Physical Hydrology for Ecosystems, 69, 70, 71, 107, 121
BEE 4270: Water Sampling and Measurement, 69, 70, 73
BEE 4350: Principles of Aquaculture, 107
BEE 4500: Bioinstrumentation, 107, 110
BEE 4530: Computer-Aided Engineering: Applications to Biomedical Processes, 107, 110
BEE 4540: Physiological Engineering, 107, 110
BEE 4590: Biosensors and Bioanalytical Techniques, 107, 110
BEE 4640: Bioseparation Processes, 107
BEE 4710: Introduction to Groundwater, 107, 121
BEE 4730: Watershed Engineering, 16, 69, 70, 72, 73, 107, 121
BEE 4740: Water and Landscape Engineering Applications, 121
BEE 4750: Environmental Systems Analysis, 69, 70, 71, 121
BEE 4760: Solid Waste Engineering, 120
BEE 4780: Ecological Engineering, 107, 120
BEE 4800: Introduction to Atmospheric Chemistry, 121
BEE 4840: Metabolic Engineering, 107
BEE 4890: Entrepreneurial Management for Engineers, 16, 52, 69, 70, 71, 117
BEE 4930: Technical Writing for Engineers, 16, 69, 72
BEE 4980: Undergraduate Teaching, 160
BEE 4991: Honors Research, 160
BEE 5010: Bioengineering Seminar, 111
BEE 6510: Bioremediation: Engineering Organisms to Clean Up the Environment, 107, 121
BEE 6710: Analysis of the Flow of Water and Chemicals in Soils, 121
BEE 6720: Drainage, 121
BEE Capstone Design requirement, 38, 39, 40, 41
BEE Laboratory Experience requirement, 38, 39, 40, 41
BEE Major Coordinator, 106
Behrman Biology Center, 8
Belina, John (Professor), 189, 191
BE Undergraduate Major Coordinator, 120
BIO 1109: Biological Principles, 39, 40
BIO 1110: Biological Principles, 39, 40
BIOAP 3110: Introductory Animal Physiology, Lectures, 110
BIOBM 3300: Principles of Biochemistry, Individual Instruction, 37, 39, 40, 46, 47, 106, 110
BIOBM 3310: Principles of Biochemistry: Proteins and Metabolism, 39, 46, 106, 110
BIOBM 3320: Principles of Biochemistry: Molecular Biology, 36, 46, 106, 110
BIOBM 3330: Principles of Biochemistry: Proteins, Metabolism, and Molecular Biology, 37, 39, 40, 110
Bioenvironmental Engineering Concentration in BE, 38, 68, 107–8
BIOG 1100, 96, 97
BIOG 1101: Biological Sciences, Lectures, 18, 37, 39, 40, 46, 69, 70, 71, 95, 96, 97, 110
BIOG 1102: Biological Sciences, Lectures, 37, 39, 40, 46, 69, 70, 71, 95, 96, 97, 110
BIOG 1103: Biological Sciences, Laboratory, 18, 37, 39, 40, 46, 69, 70, 71, 95, 96, 97, 110
BIOG 1104: Biological Sciences, Laboratory, 37, 39, 40, 46, 69, 70, 71, 95, 96, 97, 110
BIOG 1105: Introductory Biology, 18, 34, 39, 41, 46, 69, 70, 71, 110
BIOG 1106: Introductory Biology, 39, 41, 46, 69, 70, 71, 110
BIOG 1107: General Biology, 18, 46, 69, 71, 110
BIOG 1108: General Biology, 46, 69, 70, 71
BIOG 1109: Biological Principles, 110
BIOG 1109: Biological Principles, 41, 69, 70, 71, 72, 95, 96, 97
BIOG 1110: Biological Principles, 41, 69, 70, 71, 95, 110
BIOGD 2810: Genetics, 110
Biological and Environmental Engineering (M.Eng.) program, 175
Biological and Environmental Engineering, Department of, 37, 68, 106, 120
Biological and Environmental Engineering Society, 185
Biological Engineering, Institute for (IBE), 188–89
Biological Engineering, Undergraduate Program Director of, 163
Biological Engineering (BE) Major, 13, 14, 17, 37–41
and academic standing, criteria for, 155
affiliation, requirements for, 34
check lists, 40
Concentrations, 38, 68
electives, approved, 38
engineering distributions, 37
Environmental Engineering Option in, 13
flow chart, 39
honors program, 160–61
required major courses, 37–38, 40
undergraduate consultants and coordinators, 10
Biological Engineering Minor, 99, 106–8, 109
biology courses, 18
Biomedical Engineering (M.Eng.) program, 175
Biomedical Engineering, Department of, 109
Biomedical Engineering Concentration in BE, 38, 107
Biomedical Engineering Minor, 99, 109–11
Biomedical Engineering Society, 185
BIOMI 2900: General Microbiology Lectures, 37, 39, 40, 46, 72, 106, 110
BIONB 2220: Neurobiology and Behavior II: Introduction to Neurobiology, 106, 110
BIONB 3300: Introduction to Computational Neuroscience, 110
BIONB 4700: Biophysical Methods, 110
BIONB 4910: Principles of Neurophysiology, 110
Bioprocess Engineering Concentration in BE, 38, 107
Bland, Robert, 12
BME 3010: Molecular Principles of Biomedical Engineering, 110, 111
BME 3020: Cellular Principles of Biomedical Engineering, 110, 111
BME 3300: Introduction to Computational Techniques, 107, 110
BME 3600: Molecular and Cellular Bioengineering, 110
BME: 4010: Biomedical Engineering Analysis of Metabolic and Structural Systems, 107, 110, 111
BME 4020: Electrical and Chemical Physiology, 110, 111
BME 4110: Science and Technology Approaches to Problems in Health, 110
BME 4420: Instrumentation for Biology, 107
BME 4640: Orthopaedic Tissue Mechanics, 110
BME 4810: Biomedical Engineering, 110
BME 4910: Principles of Neurophysiology, 110
BME 5010: Bioengineering Seminar, 111
BME 5020: Biomedical System Design, 107, 111
BME 5390: Biomedical Materials and Devices for Human Body Repair, 107, 111
BME 5620: Biomineralization: The Formation and Properties of Inorganic Biomaterials, 111
BME 5650: Biomechanical Systems—Analysis and Design, 107
BME 5700: Biophysical Methods, 110
BME 5810: Soft Tissue Biomechanics, 111
BMES. See Biomedical Engineering Society
Boston University, 136
BTRY 4090: Theory of Statistics, 118
BTRY 6020: Statistical Methods II, 118
BTRY 6030: Statistical Methods III, 118
Bursar, Office of, 9
Business for Engineering Students Minor, 100, 133, 135
business school, preparation for, 29
Byron W. Saunders Prize, 182

C
CA courses. See Cultural Analysis courses
CAEPS. See Cornell AEP Society
Campus Life, 8, 9
Cantabria (Spain), studying in, 136
Cardie, Claire, 11
career and professional development
careers in engineering, 21–25, 27
deciding on a career, 172
graduate programs, 174–75
professional and technical societies, 176
professional engineer licensing, 177
services at Cornell, 9, 29, 172–74
CASE. See Cornell Advanced Standing Examination
Casler, Carol, 10, 109
CCAMS. See Cornell Chapter of the American Meteorological Society
CCGB. See College Curriculum Governing Board
CDE. See Cumulating Design Experience
CE. See Civil Engineering Major
CEAA. See Cornell Engineering Alumni Association
CE Curriculum Committee, 161
CEE 3040: Uncertainty Analysis in Engineering, 38, 39, 40, 41, 44, 45, 49, 50, 51, 52, 69, 70, 71, 72, 87, 89, 90, 103, 116, 117, 125, 133
CEE 3230: Environmental Economics and Management, 48, 49, 50, 51, 69, 70, 71, 116
CEE 3310: Fluid Mechanics, 38, 39, 40, 49, 50, 51, 69, 70, 71, 104, 121
CEE 3320: Hydraulic Engineering, 121
CEE 3410: Introduction to Geotechnical Engineering for the Earth Science, 48, 49, 50, 51, 69, 70, 71, 112
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 3510</td>
<td>Environmental Quality Engineering</td>
<td>49, 50, 51, 52, 69, 70, 71, 120</td>
</tr>
<tr>
<td>CEE 3610</td>
<td>Introduction to Transportation Engineering</td>
<td>49, 50, 51, 52</td>
</tr>
<tr>
<td>CEE 3710</td>
<td>Structural Modeling and Behavior</td>
<td>49, 50, 51, 104, 112</td>
</tr>
<tr>
<td>CEE 3720</td>
<td>Intermediate Solid Mechanics</td>
<td>50, 52, 112</td>
</tr>
<tr>
<td>CEE 4000</td>
<td>Senior Honors Thesis</td>
<td>161</td>
</tr>
<tr>
<td>CEE 4010</td>
<td>Undergraduate Engineering Teaching in CEE</td>
<td>161</td>
</tr>
<tr>
<td>CEE 4060</td>
<td>Civil Infrastructure Systems</td>
<td>116</td>
</tr>
<tr>
<td>CEE 4320</td>
<td>Hydrology</td>
<td>121</td>
</tr>
<tr>
<td>CEE 4360</td>
<td>Case Studies in Environmental Fluid Mechanics</td>
<td>121</td>
</tr>
<tr>
<td>CEE 4370</td>
<td>Experimental Methods in Fluid Dynamics</td>
<td>69, 70, 73, 121</td>
</tr>
<tr>
<td>CEE 4400</td>
<td>Foundation Engineering</td>
<td>112</td>
</tr>
<tr>
<td>CEE 4410</td>
<td>Retaining Structures and Slopes</td>
<td>112</td>
</tr>
<tr>
<td>CEE 4440</td>
<td>Environmental Site and Remediation Engineering</td>
<td>112, 120</td>
</tr>
<tr>
<td>CEE 4510</td>
<td>Microbiology for Environmental Engineering</td>
<td>37, 39, 40, 46, 69, 70, 71, 72, 108, 120</td>
</tr>
<tr>
<td>CEE 4520</td>
<td>Water Supply Engineering</td>
<td>108, 120</td>
</tr>
<tr>
<td>CEE 4530</td>
<td>Laboratory Research in Environmental Engineering</td>
<td>69, 70, 73, 120</td>
</tr>
<tr>
<td>CEE 4540</td>
<td>Sustainable Small-Scale Water Supplies</td>
<td>120</td>
</tr>
<tr>
<td>CEE 4550</td>
<td>AguaClara: Sustainable Water Supply Project</td>
<td>120</td>
</tr>
<tr>
<td>CEE 4610</td>
<td>Urban Transportation and Modeling</td>
<td>50, 52</td>
</tr>
<tr>
<td>CEE 4630</td>
<td>Transportation and Information Technology</td>
<td>50, 52</td>
</tr>
<tr>
<td>CEE 4640</td>
<td>Transportation System Design</td>
<td>50, 52</td>
</tr>
<tr>
<td>CEE 4650</td>
<td>Environment/Energy, and Transportation Planning and Management</td>
<td>50, 52</td>
</tr>
<tr>
<td>CEE 4710</td>
<td>Fundamentals of Structural Mechanics</td>
<td>50, 52, 112</td>
</tr>
<tr>
<td>CEE 4720</td>
<td>Introduction to the Finite Element Method</td>
<td>102, 112</td>
</tr>
<tr>
<td>CEE 4730</td>
<td>Design of Concrete Structures</td>
<td>50, 52, 112</td>
</tr>
<tr>
<td>CEE 4740</td>
<td>Design of Steel Structures</td>
<td>50, 52, 112</td>
</tr>
<tr>
<td>CEE 4770</td>
<td>Introduction to Composite Materials</td>
<td>102</td>
</tr>
<tr>
<td>CEE 4780</td>
<td>Structural Dynamics and Earthquake Engineering</td>
<td>49, 50, 52, 112</td>
</tr>
<tr>
<td>CEE 4920</td>
<td>Engineers for a Sustainable World: Engineering in International Development, 116, 188, 120</td>
<td></td>
</tr>
<tr>
<td>CEE 5930</td>
<td>Engineering Management Methods</td>
<td>116</td>
</tr>
<tr>
<td>CEE 5940</td>
<td>Economic Methods for Engineering and Management</td>
<td>116</td>
</tr>
<tr>
<td>CEE 5950</td>
<td>Construction Planning and Operations</td>
<td>112, 116</td>
</tr>
<tr>
<td>CEE 5960</td>
<td>Management Issues in Forensic Engineering</td>
<td>116</td>
</tr>
<tr>
<td>CEE 5970</td>
<td>Risk Analysis and Management</td>
<td>116, 120</td>
</tr>
<tr>
<td>CEE 5980</td>
<td>Intro to Decision Analysis</td>
<td>116</td>
</tr>
<tr>
<td>CEE 6230</td>
<td>Environmental Quality Systems Engineering</td>
<td>121</td>
</tr>
<tr>
<td>CEE 6330</td>
<td>Flow in Porous Media and Groundwater</td>
<td>121</td>
</tr>
<tr>
<td>CEE 6530</td>
<td>Water Chemistry for Environmental Engineering</td>
<td>121</td>
</tr>
<tr>
<td>CEE 6540</td>
<td>Aquatic Chemistry</td>
<td>46</td>
</tr>
<tr>
<td>CEE 6550</td>
<td>Transport, Mixing, and Transformation in the Environment</td>
<td>121</td>
</tr>
<tr>
<td>CEE 6560</td>
<td>Physical/Chemical Process</td>
<td>121</td>
</tr>
<tr>
<td>CEE 6570</td>
<td>Biological Processes</td>
<td>121</td>
</tr>
<tr>
<td>CEE 6580</td>
<td>Biodegradation and Biocatalysis</td>
<td>121</td>
</tr>
</tbody>
</table>

**CHEE (College Entrance Examination Board) exams**, 148, 149, 150
- for AP Biology, 109, 110
- for AP English Literature and Composition, 151
- for AP English Language and Composition, 151
- for AP foreign language, 149

**CEE Undergraduate Handbook**, 48, 72
CEE Undergraduate Major Coordinator, 112
Center for Learning and Teaching, 8
CE Undergraduate Major Coordinator, 116, 120
Change of Major and/or Advisor form, 169
Charles Lee Crandall Prizes, 179
CHEM 1570: Introduction to Organic and Biological Chemistry, 13, 37, 39, 40, 50, 51, 70, 71, 95, 96, 97, 98
CHEM 2070: General Chemistry, 66, 96
CHEM 2080: General Chemistry, 13, 15, 21, 44, 50, 51, 56, 78, 79, 80, 92, 94, 95, 96, 97, 98, 151
CHEM 2150:Honors General and Inorganic Chemistry, 62, 66, 71, 79, 84, 89, 97, 151
CHEM 2160: Honors General and Inorganic Chemistry, 78, 79, 80
CHEM 2510: Introduction to Experimental Organic Chemistry, 42, 44, 45
CHEM 2570, 96, 97
CHEM 2900: Introductory Physical Chemistry Laboratory, 42, 44, 45
CHEM 3000: Quantitative Chemistry, 107
CHEM 3570: Organic Chemistry for the Life Sciences, 13, 37, 39, 40, 42, 44, 45, 46, 71
CHEM 3890: Honors Physical Chemistry I, 18, 42, 44, 45, 46
CHEM 3900: Honors Physical Chemistry II, 42, 44, 45, 46
ChemE. See Chemical Engineering Major
CHEME 2880: Biomolecular Engineering: Fundamentals and Applications, 46
CHEME 3010: Nonresident Lectures, 42, 44, 45
CHEME 3130: Chemical Engineering Thermodynamics, 42, 44, 45
CHEME 3230: Fluid Mechanics, 42, 44, 45, 104, 121
CHEME 3240: Heat and Mass Transfer, 42, 44, 45
CHEME 3320: Analysis of Separation Processes, 42, 44, 45, 107
CHEME 3720: Introduction to Process Dynamics and Control, 42, 44, 45
CHEME 3900: Chemical Kinetics and Reactor Design, 42, 44, 45
CHEME 4010: Molecular Principles of Biomedical Engineering, 43, 46, 47, 110
CHEME 4020: Cellular Principles of Biomedical Engineering, 43, 46, 47, 110
CHEME 4320: Chemical Engineering Laboratory, 16, 42, 44, 45
CHEME 4620: Chemical Process Design, 42, 44, 45
CHEME 4700: Process Control Strategies, 43
CHEME 4720: Feedback Control Systems, 43, 46, 102
CHEME 4800: Chemical Processing of Electronic Materials, 43, 46
CHEME 4810: Biomedical Engineering, 43, 46, 47, 107, 110
CHEME 4840: Microchemical and Microfluidic Systems, 43, 46
CHEME 5430: Biomolecular Engineering of Bioprocesses, 43, 46, 47, 107
CHEM 6240: Physics of Micro- and Nanoscale Fluid Mechanics and Heat Transfer, 43
CHEME 6310: Engineering Principles for Drug Delivery, 43, 46
CHEME 6400: Polymeric Materials, 43, 46
CHEME 6440: Aerosols and Colloids, 43
CHEME 6610: Air Pollution Control, 43, 46
CHEME 6640: Energy Economics, 43
CHEME 6650: Energy Engineering, 43
ChemE Car competition, 184
Chemical and Biomolecular Engineering, School of, 42
Chemical Engineering (M.Eng), 175
Chemical Engineering (ChemE) Major, 13, 14, 42–47
and academic standing, criteria for, 155
affiliation, requirements for, 35
check lists, 45
electives, approved, 43
Environmental Engineering Concentration in, 13
flow chart, 44
required major courses, 42
undergraduate consultants and coordinators, 10
Chemical Engineers, American Institute of (AIChE), 184
chemistry courses, 18
chemistry requirements for Bachelor of Science degree, 13, 14
Chester Buchanan Memorial Award, 178
Chi Epsilon, 185–86
CIS 3000: Introduction to Computer Game Design, 122, 126
CIS: 4002: Advanced Projects in Game Design, 122
CIS 5640: Computer Animation, 123
Cisne, John, 12
Civil and Environmental Engineering (M.Eng.) program, 175
Civil and Environmental Engineering, Associate Director of, 163
Civil and Environmental Engineering, School of, 48, 68, 112, 116, 120

Civil Engineering (CE) Major, 13, 14, 17, 48–53
and academic standing, criteria for, 155
affiliation, requirements for, 35
check lists, 51
Environmental Engineering Concentration, 48, 68
electives, approved, 49
engineering distributions, 48
flow chart, 50
honor society (Chi Epsilon), 185–86
honors program, 161
project teams, 23
required major courses, 49
undergraduate consultants and coordinators, 10

Civil Engineers, American Society of (ASCE), 184
Civil Infrastructure Minor, 99, 112–13
Clark Construction Group, LLC Prize, 179
class ranking, 159
CMS. See Cornell Materials Society
Code of Academic Integrity, 158–59
COGST 1101: Introduction to Cognitive Science, 126
COGST 3300: Introduction to Computational Neuroscience, 110

College Curriculum Governing Board (CCGB), 1, 14
Engineering Advising and, 26
and ROTC courses, 144
Subcommittee on Technical Writing, 16, 137

College Entrance Examination Board exams. See CEEB
College of Engineering, 1, 109
and academic standing, criteria for, 154
and decisions on AP/transfer credit, 148
directory of resources, 8
dual-degree program in, 134
educational objectives of, 7
graduate programs in, 174–75
Majors. See Majors, College of Engineering
Minors. See Minors, Engineering
mission, 6–7
student organizations, 183–91
web site, 24
withdrawal from, 168

COMM 2630: Organizational Writing, 16
COMM 3450: Human–Computer Interaction Design, 123
COMM 3520: Science Writing for the Mass Media, 16
COMM 4220: Psychology of Entertainment, 123
COMM 4400: Advanced Human–Computer Interaction Design, 123
Committee on Academic Standards, Petitions, and Credit (ASPAC), 134, 1
and academic standing, 154
and Advanced Placement exams, 150
and unaffiliated students, 158
Common Curriculum, 14, 16, 135
Communication, Department of, 16
Computer Engineering. See Electrical and Computer Engineering Major; Electrical and Computer Engineering Minor
Computer Science (M.Eng.) program, 175
Computer Science, Department of, 54, 74, 114, 122, 125
for tutorial services, 8
Computer Science (CS) Major, 13, 14, 54–58
  and academic standing, criteria for, 155
  affiliation, requirements for, 35
  check lists, 57
  electives, approved, 54–55
  engineering distributions, 54
  flow chart, 56
  honors program, 162
  project team, 23
  required major courses, 54
  undergraduate consultants and coordinators, 10
Computer Science Minor, 99, 114
Computer Science Prize for Academic Excellence, 179
Computer Science Undergraduates, Association of (ACSU), 185
computer terminals, public, 171
computing requirements for Bachelor of Science degree, 13, 15
Continuing Education and Summer Sessions, School of, 9, 168
Co-op. See Engineering Cooperative Education Program
cooperative education, 27, 30
Cooperative Education Program, 8
Cornell, Ezra, 6
Cornell Abroad, 20, 136
Cornell Advanced Standing Examination (CASE), 149
Cornell AEP Society (CAEPS), 186
Cornell Career Services, 9, 28
  and investigating Majors, 158
  job postings, 172
  library, 24
  preprofessional advising services, 29
  programs offered by, 173–74
  transferring to another Cornell college, 170
Cornell Chapter of the American Meteorological Society (CCAMS), 186
Cornell Daily Sun, 29
Cornell Engineering Alumni Association (CEAA), 22–23
Cornell Graduate School, 174
Cornell LeaderShape® Institute, 31, 32
Cornell Materials Society (CMS), 186
Cornell United Religious Work, 8
Cornell University, mission and values of, 6
Cornell University Academic Integrity Handbook, 158
Cornell Weill Medical College, 175
Counseling and Psychological Services, 8
Course and Room Roster, 141
Course and Time Roster, 142
CoursEnroll, 143
courses
  adding/dropping, 26, 141–42
  changing, 26
  credit, 15, 20
  enrollment, 141
  extramural, 168
  “permission only,” 141, 142, 143
  pre-enrollment, 143
  supplementary, 144
  variable credit, 143
See also Advanced Placement credit; credit hours; Engineering Registrar; grades; transfer credit
Courses of Study, 195
Advanced Placement guidelines, 150
departmental office listings, 141
graduation requirements, 14
Liberal Studies courses, approved, 18
prerequisites, 21
technical writing courses, approved, 49, 69
credit, 15, 20. See also Advanced Placement credit; grades; transfer credit
credit hours
changing, 143
for extramural courses, 168
maximum per semester, 144
required for graduation, 13
CS. See Computer Science Major
CS 1109: Fundamental Programming Concepts, 15
CS 1110: Introduction to Computing Using Java, 13, 15, 21, 31, 38, 39, 40, 44, 45, 48, 50, 51, 56, 57,
61, 62, 65, 66, 70, 71, 83, 84, 88, 89, 92, 93, 96, 97
CS 1112: Introduction to Computing Using MATLAB, 13, 15, 21, 31, 38, 39, 40, 44, 45, 48, 50, 51, 56,
57, 61, 62, 65, 66, 70, 71, 78, 79, 83, 84, 88, 89, 92, 93, 96, 97
CS 1113: Computing Using Java: Honors, 13, 15, 21, 38, 39, 40, 44, 45, 50, 51, 56, 57, 61, 62, 65, 66,
70, 71, 78, 79, 83, 84, 88, 89, 92, 93, 96, 97
CS 1114: Introduction to Computing Using MATLAB and Robotics, 13, 15, 21, 38, 39, 40, 44, 45, 50,
51, 56, 57, 61, 62, 65, 66, 70, 71, 78, 79, 83, 84, 88, 89, 92, 93, 96, 97
CS 1130: Transition to Object-Oriented Programming, 13, 15, 38, 39, 40, 44, 45, 48, 50, 51, 56, 57,
61, 62, 65, 66, 70, 71, 73, 78, 79, 83, 84, 88, 89, 92, 93, 96, 97
CS 1132: Transition to MATLAB, 13, 15, 38, 39, 40, 44, 45, 48, 50, 51, 56, 57, 61, 62, 65, 66, 70, 71,
78, 79, 83, 84, 92, 93, 96, 97
CS 2110: Object-Oriented Programming and Data Structures, 31, 35, 56, 74, 78, 79, 80, 114, 122, 125
CS 2111: Programming Practicum, 35, 54, 56, 57
CS 2800: Discrete Structures, 13, 35, 54, 56, 57, 78, 79, 80, 92, 94, 104, 114
CS 2850: Networks, 104
CS 3110: Data Structures and Functional Programming, 54, 56, 57
CS 3220: Introduction to Scientific Computation, 56, 114
CS 3410: Systems Programming, 54, 56, 57, 59, 114
CS 3420: Computer Organization, 54, 56, 57, 59, 114
CS 3810: Introduction to Theory of Computing, 54, 56, 57, 104
CS 4210: Numerical Analysis and Differential Equations, 54, 56, 57, 103, 114
CS 4220: Numerical Analysis: Linear and Nonlinear Equations, 54, 56, 57, 114
CS 4320: Introduction to Database Systems, 76, 125
CS 4410: Operating Systems, 54, 56, 57
CS 4450: Computer Networks, 76, 122
CS 4620: Introduction to Computer Graphics, 76, 122, 125
CS 4700: Foundations of Artificial Intelligence, 76, 122, 125
CS 4740: Introduction to Natural Language Processing, 76
CS 4780: Machine Learning, 76, 122
CS 4820: Introduction to Analysis of Algorithms, 54, 56, 57, 104
CS 4999: Independent Reading and Research, 114, 162
CS 5150: Software Engineering, 76, 125
CS 5300: The Architecture of Large-Scale Information Systems, 125
CS 5430: System Security, 76, 125
CS 5620: Interactive Computer Graphics, 122
CS 5643: Physically Based Animation for Computer Graphics, 122
CS 5780: Empirical Methods in Machine Learning and Data Mining, 76, 125
CSS 3650: Environmental Chemistry: Soil, Air, and Water, 69, 70, 71
CUAIR (ECE project), 60
CUAUV (ECE project), 60
CU Emerge, 138
Cultural Analysis (CA) courses, 18–19
  in BE Major curriculum, 41
  in CE Major curriculum, 53
  in ChemE Major curriculum, 47
  in CS Major curriculum, 58
  in ECE Major curriculum, 63
  in EnvE Major curriculum, 72
  in EP Major curriculum, 67
  in ISST Major curriculum, 80
  in ME Major curriculum, 90
  in MSE Major curriculum, 85
  in OR&E Major curriculum, 94
  in SES Major curriculum, 98
Cumulating Design Experience (CDE), 60
CUSAT Nanosatellite, 23

D
David Delano Clark Award, 179
DEA 4700: Applied Ergonomics Methods, 76, 126
Dean, Associate, 11
Dean of Students Office, 8, 9, 158
Dean’s List, 159
Digital Gaming Alliance (DGA), 186–87
Dining and Housing Office, 9
directory of resources, 8–9
Disability Services, Student, 9
diversity at Cornell, 1
Diversity Dinner, 22
Diversity Programs in Engineering, 8, 30–31
  and American Indian Science and Engineering Society, 183
  and National GEM Consortium, 176
  and National Society of Black Engineers, 189
  and Society of Hispanic Professional Engineers, 190
  and Society of Women Engineers, 191
Doctor of Philosophy (Ph.D.) program, 174–75
Doing, Park (Professor), 188
Dorothy and Fred Chau Award, 179
double-Major programs, 27, 134–35
Douglas Whitney ’61 Award, 182
Downey, Christa, 189
DPS. See Diversity Programs in Engineering
Dresden (Germany), studying in, 136
dual-degree programs, 27, 134
Duncan, T. Michael, 10

E
Early Admission Petition and Course Record Form, 176
everal decision option, 176
EARS (Empathy, Assistance, and Referral Service), 8
Earth and Atmospheric Sciences, Department of, 95, 132
Earth and Life Sciences courses, 18
EAS 2200: The Earth System, 95, 96, 97, 132
EAS 3010: Evolution of the Earth System, 95, 132
EAS 3030: Introduction to Biogeochemistry, 69, 70, 71, 95, 132
EAS 3040: Interior of the Earth, 95, 132
EAS 3050: Climate Dynamics, 95, 132
EAS 4800: Introduction to Atmospheric Chemistry, 121
EAS 4910: Undergraduate Research, 166
EAS 4920: Undergraduate Research, 166
EAS 4990: Undergraduate Research in Atmospheric Science, 166
ECE. See Electrical and Computer Engineering Major
ECE 2100: Introduction to Circuits for Electrical and Computer Engineers, 35, 59, 61, 65, 102, 115, 156
ECE 2200: Signals and Information, 35, 61, 115, 156
ECE 2300: Introduction to Digital Logic Design, 35, 59, 61, 62, 65, 115, 156
ECE 3030: Electromagnetic Fields and Waves, 59, 115
ECE 3100: Introduction to Probability and Random Signals, 17, 59, 103, 115, 118
ECE 3110: Electrical and Computer Engineering Honors Seminar, 162
ECE 3140: Computer Organization, 54, 56, 57, 59, 114, 115
ECE 3150: Introduction to Microelectronics, 59, 115
ECE 3200: Networks and Systems, 104
ECE 3910: Junior Electrical and Computer Engineering Independent Project, 60
ECE 3920: Junior Electrical and Computer Engineering Independent Project, 60
ECE 4110: Random Signals in Communications and Signal Processing, 104, 118
ECE 4150: GPS: Theory and Design, 60, 102
ECE 4250: Digital Signal Processing, 104
ECE 4260: Applications of Signal Processing, 60
ECE 4370: Fiber and Integrated Optics, 60
ECE 4530: Analog Integrated Circuit Design, 60
ECE 4720: Feedback Control Systems, 102
ECE 4750: Computer Architecture, 60
ECE 4760: Digital Systems Design Using Microcontrollers, 60, 123
ECE 4910: Senior Electrical and Computer Independent Engineering Project, 60
ECE 4920: Senior Electrical and Computer Independent Engineering Project, 60
ECE 5020: Biomedical System Design, 111
ECE 5620: Fundamental Information Theory, 76, 126
ECE 5780: Computer Analysis of Biomed Images, 107, 111
ECE undergraduate Major coordinator, 115
Ecole Central Paris, 136
ECP. See Engineering Communications Program
ECON 1110: Introductory Microeconomics, 133
ECON 3010: Microeconomics, 75, 78, 79, 80, 126, 127
ECON 3130: Intermediate Microeconomic Theory, 75, 78, 79, 80, 126, 127
ECON 3680: Game Theory, 77, 80, 126, 127
ECON 4190: Economic Decisions Under Uncertainty, 77, 126
ECON 4760: Decision Theory I, 126
ECON 4770: Decision Theory II, 126
Encourage Youth, Educate Society (EYES), 138, 187
electives (approved), 13, 20. See also under specific Majors
Electrical and Computer Engineering (M.Eng.) program, 175
Electrical and Computer Engineering, School of, 59, 115
Electrical and Computer Engineering (ECE) Major, 14, 17, 59–63
and academic standing, criteria for, 155
affiliation, requirements for, 35
check lists, 62
concentration, areas of, 59
Cumulating Design Experience (CDE), 60
electives, approved, 60
engineering distributions, 59
flow chart, 61
honor society (Eta Kappa Nu), 188
honors program, 162
projects, 60
project team, 23
required major courses, 59
undergraduate consultants and coordinators, 10
Electrical and Computer Engineering Minor, 99, 115
Electrical and Electronics Engineers, Institute for (IEEE), 189
Electrical Sciences courses, 18
Empathy, Assistance, and Referral Service (EARS), 8
employment
  listings, 24, 173
  job-search strategies, 27, 30, 172, 173
  work experience, 173
  See also career and professional development
Encourage Youth, 138
Energy Balances courses, 18
engineering, careers in, 21–25
Engineering, College of. See College of Engineering
Engineering Admissions, 187
Engineering Advising, 1, 8, 14, 18
  and adding/dropping courses, 142
  and Advanced Placement credit, 150, 153
  and credit hours, exceeding, 144
  and double-Major program, 134, 135
  engineering Minors, information about, 100
  and extramural study, 20
  and first-year transfer students, 153
  and incomplete grades, 148
  programs and services of, 26, 29
  and registration, 141
  and study abroad, 136
  and S/U grading option, 147
  and transferring to another engineering Major, 169
  and withdrawal from the engineering degree program, 168
Engineering Ambassadors Association, 187
engineering awards, 178–82
Engineering Career Services, 8, 9
Engineering Communications Program (ECP), 8, 136–37
Engineering Conference, 23
Engineering Cooperative Education and Career Services, 8, 9
  information on the Co-op, 137
  job-search assistance, 28
  services of, 172–73
Engineering Cooperative Education Program (Co-op), 137, 173
  and graduating cum laude, 159
  honor society (Mu Sigma Tau), 189
Engineering Day, 22, 185
engineering distribution requirements, 13, 16–18. See also under specific majors
Engineering Learning Initiatives, 8
  services of, 31–32
  undergraduate research assistance, 137, 138
Engineering Library, 8
Engineering Management (M.Eng.) program, 175
Engineering Mechanics (M.Eng.) program, 175
Engineering Minors. See Minors, Engineering
Engineering Physics Major, 14, 17, 64–67
  and academic standing, criteria for, 156
  affiliation, requirements for, 35
  check lists, 66
  engineering distributions, 64
  flow chart, 65
  honors program, 163
required major courses, 64
undergraduate consultants and coordinators, 11
Engineering Physics (M.Eng.) program, 175
Engineering Registrar, 8, 32
adding/dropping courses, 141, 142
class ranking, 159
Petition for Double Major form, 134, 167
registration process, 141
and transfer credit award, 152
Engineering Statistics Minor, 99, 118–19
Engineering Student Assembly, 187
Engineering Student Council (ESC), 22, 183, 187–88
Engineering Student organizations, 23, 183–91
Engineering student project teams, 23
Engineering Student Services, 138
Engineering Summer Scholars Program (ESSP), 30
Engineering TA Training, 31, 32
Engineers for a Sustainable World (ESW), 23, 188
English as a Second Language, 145
English for Later Bilinguals, 145
ENGRC 3020: Writing-intensive Opportunity: Practicum in Technical Writing, 15, 16, 75, 78, 79, 80
ENGRC 3350: Communications for Engineering Managers
ENGRC 3500: Engineering Communications, 15
ENGRD 2010: Introduction to the Physics and Chemistry of the Earth, 18
ENGRD 2030: Dynamics, 17, 49, 50, 51, 53, 86, 88, 89, 90, 102, 129
ENGRD 2100: Introduction to Circuits for Electrical and Computer Engineers, 35, 50, 59, 81, 87, 88, 89, 102, 115, 156, 157
ENGRD 2110: Object-Oriented Programming and Data Structures, 18, 48, 52, 54, 57, 59, 62, 75, 78, 91, 92, 93, 94, 114, 122, 157
ENGRD 2190: Mass and Energy Balances, 18, 42, 44, 45, 81
ENGRD 2210: Thermodynamics, 18, 36, 38, 39, 40, 48, 50, 68, 69, 70, 71, 86, 88, 89, 102
ENGRD 2300: Introduction to Digital Logic Design, 18, 35, 54, 59, 61, 62, 115, 156
ENGRD 2510: Engineering for a Sustainable Society, 18, 34, 35, 38, 39, 40, 48, 50, 52, 68, 70, 71, 120
ENGRD 2520: The Physics of Life, 18, 64, 81, 110
ENGRD 2600: Principles of Biological Engineering, 18, 34, 37, 38, 39, 40, 81
ENGRD 2610: Mechanical Properties of Materials; From Nanodevices to Superstructures, 17, 35, 48, 50, 52, 81, 83, 84
ENGRD 2620: Electronic Materials for the Information Age, 17, 35, 81
ENGRD 2640: Computer-Instrumentation Design, 16, 18, 58, 64, 65, 66, 67, 81
ENGRD 2700: Basic Engineering Probability and Statistics, 17, 35, 36, 38, 39, 40, 41, 44, 45, 50, 52, 58, 70, 72, 74, 75, 78, 79, 82, 87, 89, 90, 91, 92, 93, 103, 116, 118, 124, 125, 131, 133, 157
ENGRD 3200: Engineering Computation, 48, 49, 50, 51, 52, 68, 69, 70, 71, 82, 87, 89, 90, 103
ENGRD 3220: Introduction to Scientific Computation, 54, 56, 57, 103, 114
ENGRG 1050: Engineering Seminar, 21, 22, 28–29, 38, 39, 40, 41
ENGRG 2350: Career Development for Engineering, 172
ENGRG 4610: Entrepreneurship for Engineers, 117
ENGRG 6780: Teaching Seminar, 32
ENGRI 1100: Lasers and Photonics, 16, 64, 66
ENGRI 1101: Engineering Applications of Operations Research, 16
ENGRI 1110: Nanotechnology, 16
ENGRI 1120: Introduction to Chemical Engineering, 16
ENGRI 1130: Water Treatment Design, 17, 68, 70, 72, 121
ENGRI 1160: Modern Structures, 17
ENGRI 1170: Introduction to Mechanical Engineering, 17
ENGRI 1180: Design Integration: DVDs and iPods, 17
Engri 1190: Biomaterials for the Skeletal System, 17
Engri 1200: Introduction to Nanoscience and Nanoengineering, 16, 64, 66
Engri 1220: Earthquake!, 17, 95, 96
Engri 1260: Introduction to Signals and Telecommunications, 17
Engri 1270: Introduction to Entrepreneurship and Enterprise Engineering, 17
Engri 1310: Introduction to Biomedical Engineering, 109, 110
Engri 1610: Computing in the Arts, 17
Engri 1670: Visual Imaging in the Electronic Age, 17
enrollment status, 33. See also courses
Enterprise Engineering Seminar, 23
EnvE. See Environmental Engineering Major
Environmental Engineering (EnvE) Major, 13, 14, 17, 68–73
and academic standing, criteria for, 156
affiliation, requirements for, 35
check lists, 71
electives, approved, 69
engineering distributions, 68
flow chart, 70
honors program, 163
project team, 23
required major courses, 69
undergraduate consultants and coordinators, 11
Environmental Engineering Concentration in CE, 13, 48, 68
Environmental Engineering Minor, 99, 120–21
Environmental Engineering Option in BE, 13
EP. See Engineering Physics Major
EP Honors Committee, 163
Equal Opportunity, Office of, 8
ESC. See Engineering Student Council
ESSP. See Engineering Summer Scholars Program
ESW. See Engineers for a Sustainable World
Eta Kappa Nu (HKN), 188
externships, 25
extramural study, 20, 168
EYES. See Encourage Youth, Educate Society
F
faculty advisors. See advising, faculty
Fdsc 4170: Food Chemistry I, 46
fellowships, 173, 176
Ferdinand Rodriguez Outstanding Student Award in Polymers and Electronic Materials, 181
Fine, Terrence, 10
financial aid
for double-Majors, 134
for underrepresented and minority students, 176
Financial Aid and Student Employment, 9, 168
first-year requirements, 21, 141. See also Engrg 1050: Engineering Seminar
first-year writing seminar, 13, 15, 21
AP credit for, 151
in BE Major curriculum, 39, 40
in CE Major curriculum, 50
in ChemE Major curriculum, 44, 45
in CS Major curriculum, 56
in ECE Major curriculum, 61, 62
in EnvE Major curriculum, 70, 71
in EP Major curriculum, 65, 66
and An Introduction to Writing in the University, 144
in ISST Major curriculum, 78, 79, 80
in ME Major curriculum, 88, 89
in MSE Major curriculum, 83, 84
and non-native speakers of English, 145
in OR&E Major curriculum, 92, 93
in SES Major curriculum, 96, 97
Fisher, Elizabeth, 12
Five-Year Program, 139
Foreign Languages courses, 19
    in BE Major curriculum, 41
    in CE Major curriculum, 53
    in ChemE Major curriculum, 47
    in CS Major curriculum, 58
    in ECE Major curriculum, 63
    in EnvE Major curriculum, 72
    in EP Major curriculum, 67
    in ISST Major curriculum, 80
    in ME Major curriculum, 90
    in MSE Major curriculum, 85
    in OR&E Major curriculum, 94
    in SES Major curriculum, 98
Frank H. T. Rhodes Award, 181
Frank O. Ellenwood Prize, 180
Frank W. and Emily Wood Fund, 182
FRESH Externship Program, 25
Freshman Orientation, 144
Friedman, Eric, 11
FSAD 4390: Biomedical Materials and Devices for Human Body Repair, 111
FSAE (ECE project), 60
Fuertes Medal, 180
Fundamentals of Engineering exam, 177, 184

G
Game Design Minor, 99, 122–23
Gannett Health Center, 9, 141
    and medical leaves of absence, 167
Geller, Vivian, 170
General Certificate of Education (GCE) Advanced (A-Level) examinations, 148, 150, 151
Geohring, Larry, 185
Geological Sciences (M.Eng.) program, 175
George, Albert (Professor), 190
George F. Scheele Outstanding Junior Award, 182
Germany, studying in, 136
Goodwin, Sandi, 10
Gossett, James (Professor), 185
grades
    changing a grade option, 142, 146–47
    Dean’s List, requirements for, 159
    for double-Majors, 134
    grading system, 146–47
    incompletes, 147–48
See also academic standing
Graduate and Professional Programs, 174
Graduate Field Offices, 174, 175
Graduate Management Admission Test (GMAT), 139
graduate programs
    advising for, 27, 29, 173
    in College of Engineering, 174–75
    planning for, 174
graduation requirements, 13, 14–20, 144. See also academic standing
Gries, David, 11
Guadalajara (Mexico), studying in, 136

H
HA. See Historical Analysis courses
HADM 4489: The Law of the Internet and e-Commerce, 77
HADM 5574: Strategic Information Systems, 80, 127
Health Careers Programs, 29
health-related careers, 13
Hiram Sibley Prizes, 182
Historical Analysis (HA) courses, 19
in BE Major curriculum, 41
in CE Major curriculum, 53
in ChemE Major curriculum, 47
in CS Major curriculum, 58
in ECE Major curriculum, 63
in EnvE Major curriculum, 72
in EP Major curriculum, 67
in ISST Major curriculum, 80
in ME Major curriculum, 90
in MSE Major curriculum, 85
in OR&E Major curriculum, 94
in SES Major curriculum, 98
HKN. See Eta Kappa Nu
Hong Kong, studying in, 136
honor societies
Alpha Epsilon, 183
Alpha Sigma Mu, 183
Chi Epsilon, 185–86
Eta Kappa Nu, 188
Mu Sigma Tau, 189
Omega Rho International Honor Society, 190
Pi Tau Sigma, 190
Tau Beta Pi, 191
Housing and Dining Office, 9
Hulslander, Kelli, 11
Human-Centered Systems Area in ISST, 75, 76–77
Human Ecology, College of, 109
Hutson, Melissa, 1

I
IB. See International Baccalaureate Higher Level examination
IBE. See Institute of Biological Engineering
ID card, 141
IEEE. See Institute of Electrical and Electronics Engineers
ILROB 1750: Behavior, Values, and Performance, 75, 78, 79, 80
ILRST 2100: Introductory Statistics, 133
ILRST 3100: Statistical Sampling, 118
ILRST 4100: Techniques of Multivariate Analysis, 118
ILRST 4110: Statistical Analysis of Qualitative Data, 118
Independent Major (IM), 14, 135
and academic standing, criteria for, 156
affiliation, requirements for, 35
honors program, 164
undergraduate coordinator, 11
Independent Major Committee, 135, 164
India, Studying in, 136
Industrial Systems and Information Technology Minor, 100, 124
INFO 2040: Networks, 127
INFO 2140: Cognitive Psychology, 126
INFO 2300: Intermediate Design and Programming for the Web, 75, 78, 79, 126
INFO 2450: Psychology or Social Computing, 75, 78, 79, 80, 126
INFO 2921: Inventing an Information Society, 127
INFO 3200: New Media and Society, 77, 127
INFO 3300: Data-Driven Web Applications, 75, 79, 126
INFO 3450: Human–Computer Interaction Design, 76, 123, 126
INFO 3490: Media Technologies, 77, 127
INFO 3551: Computers: From the 17th Century to the Dotcom Boom, 77, 127
INFO 3561: Computing Cultures, 77, 127
INFO 3650: Technology in Collaboration, 76, 126
INFO 3660: History and Theory of Digital Art, 77, 127
INFO 3720: Explorations in Artificial Intelligence, 76
INFO 3871: The Automatic Lifestyle: Consumer Culture and Technology, 77, 127
INFO 4144: Responsive Environments, 77, 127
INFO 4290: Copyright in the Digital Age, 77, 127
INFO 4300 Information Retrieval, 76, 126
INFO 4302: Web Information Systems, 76, 126
INFO 4350: Seminar on Applications of Information Science, 77
INFO 4400: Advanced Human–Computer Interaction Design, 76, 123, 126
INFO 4450: Seminar in Computer-Mediated Communication, 76, 126
INFO 4470: Social and Economic Data, 77, 127
INFO 4500: Language and Technology, 76, 126
INFO 4850: Computational Methods for Complex Networks, 77, 127
INFO 4900: Independent Reading and Research, 74, 164
INFO 4910: Teaching in Information Science, Systems, and Technology, 164
INFO 5150: Culture, Law, and Politics of the Internet, 77, 127
INFO 5300: The Architecture of Large-Scale Information Systems, 76
information fair, 22
Information Science, Systems, and Technology (ISST) Major, 14, 74–80
  and academic standing, criteria for, 157
  affiliation, requirements for, 35
  check lists, 79
  engineering distributions, 75
  flow chart, 78
  honors program, 164
  Information Science Option, 74, 75
  Management Science Option, 74, 75–77
  required major courses, 75
  undergraduate consultants and coordinators, 11
Information Science Minor, 100, 125–27
Information Science Option in ISST, 74, 75
Information Science Student Association (ISSA), 188
Information Systems Area in ISST, 75, 76
Information Technology Management Solutions Area in ISST, 75, 76
INFORMS. See Institute for Operations Research and the Management Sciences
Institute of Biological Engineering (IBE), 188–89
Institute of Electrical and Electronics Engineers (IEEE), 189
Institute for Operations Research and the Management Sciences (INFORMS), 189
Internal Transfer Division, 9, 158, 170–71
International Baccalaureate (IB) Higher Level examination, 148, 150
International Students and Scholars Office, 8, 9
international study, 20, 27
  engineering programs for, 136
Intern Engineer Examination, 177
internships, 24, 30, 173, 176
interviewing practice, 172, 173
Introduction to Writing in the University, An, 144
Israel, studying in, 136
ISSA. See Information Science Student Association
ISST. See Information Science, Systems, and Technology Major
ITD. See Internal Transfer Division

J
Java-based courses, 15
Jay, Cindy, 11, 12, 189
Jensvold, Judy, 29
jobs. See career and professional development; employment
John E. Perry Teaching Assistant Prize, 181
John E. Perry Undergraduate Prize, 181
John G. Pertsch Jr. Prize, 181
John McMullen Dean's Prizes, 179
Johnson Graduate School of Management, 29, 138–39, 175
Jonathan E. Marx Cornell Tradition Fellowships, 180
Jonathan E. Marx Memorial Senior Prizes, 180
Jordan, Teresa (Professor), 183
Joseph O. Jeffries Prize, 180
Judicial Administrator, 9
Just the Facts, 31, 141, 143

K
Kanpur (India) studying in, 136
KCM. See Knowledge, Cognition, and Moral Reasoning courses
Knight Scholarship Program, 138–39
Knowledge, Cognition, and Moral Reasoning (KCM) courses, 19
   in BE Major curriculum, 41
   in CE Major curriculum, 53
   in ChemE Major curriculum, 47
   in CS Major curriculum, 58
   in ECE Major curriculum, 63
   in EnvE Major curriculum, 72
   in EP Major curriculum, 67
   in ISST Major curriculum, 80
   in ME Major curriculum, 90
   in MSE Major curriculum, 85
   in OR&E Major curriculum, 94
   in SES Major curriculum, 98

L
L.A. See Literature and the Arts courses
land-grant university, 6
law school, preparation for, 29
leadership opportunities, 138
Learning Strategies Center, 28
leaves of absence, 134, 167–68
   to delay graduation, 169
   forced, 158
   returning from, 168–69
Lee, Lillian, 10
Leonard, Brenda, 12
Let's Talk Walk-in Service, 8
letters of recommendation, 27
Liberal studies distribution requirements (for B.S.), 13, 18–19
license, Professional Engineer (P.E.), 177
LING 4424: Computational Linguistics, 126
LING 4474: Introduction to Natural Language Processing, 126

Literature and the Arts (LA) courses, 19
  in BE Major curriculum, 41
  in CE Major curriculum, 53
  in ChemE Major curriculum, 47
  in CS Major curriculum, 58
  in ECE Major curriculum, 63
  in EnvE Major curriculum, 72
  in EP Major curriculum, 67
  in ISST Major curriculum, 80
  in ME Major curriculum, 90
  in MSE Major curriculum, 85
  in OR&E Major curriculum, 94
  in SES Major curriculum, 98

LTC John B. Davenport Award, 179
Lunch and Learn, 31
Luo, Dan (Professor), 188
Lynn Bussey Prize, 179

M
M.B.A., 138–39, 175
MAE 1110: Naval Ship Systems, 129
MAE 2120: Mechanical Properties and Selection of Engineering Materials, 86, 88, 89, 102
MAE 2210: Thermodynamics, 102
MAE 2250: Mechanical synthesis, 86, 88, 89
MAE 3050: Introduction to Aeronautics, 101, 102
MAE 3060: Spacecraft Engineering, 101, 102
MAE 3230: Introductory Fluid Mechanics, 86, 88, 89, 102, 104, 121
MAE 3240: Heat Transfer, 86, 88, 89, 102
MAE 3250: Analysis of Mechanical and Aerospace Structures, 86, 88, 89, 102
MAE 3260: System Dynamics, 86, 88, 89, 102
MAE 3272: Mechanical Property and Performance Laboratory, 87, 88, 89, 157
MAE 3780: Mechatronics, 87, 88, 89, 102, 157
MAE 4150: GPS: Theory and Design, 102
MAE 4170: Introduction to Robotics: Dynamics, Control, Design, 102
MAE 4230: Intermediate Fluid Dynamics, 46, 102
MAE 4272: Fluid/Heat Transfer Laboratory, 16, 87, 88, 89, 90, 157
MAE 4291: Supervised Senior Design Experience, 87, 102, 129
MAE 4300: Professional Practice in Mechanical Engineering, 87, 88, 89, 157
MAE 4530: Computer-Aided Engineering Applications to Biomedical Processes, 110
MAE 4550: Introduction to Composite Materials, 102
MAE 4610: Entrepreneurship for Engineers, 90, 117
MAE 4630: Neuromuscular Biomechanics, 107
MAE 4640: Orthopaedic Tissue Mechanics, 107, 110
MAE 4660: Biomedical Engineering Analysis of Metabolism and Structural Systems, 107, 110
MAE 4700: Finite Element Analysis for Mechanical and Aerospace Design, 102
MAE 4770: Engineering Vibrations, 102
MAE 4780: Feedback Control Systems, 102
MAE 4900: Special Investigations in Mechanical and Aerospace Engineering, 102, 129
MAE 4980: Teaching Experience in Mechanical Engineering, 129–30
MAE 5060: Aerospace Propulsion Systems, 102
MAE 5070: Dynamics of Flight Vehicles, 102
MAE 5170: Introduction to Robotics: Dynamics, Control Design, 102
MAE 5230: Intermediate Fluid Dynamics, 102
MAE 5240: Physics of Micro- and Nanoscale Fluid Mechanics and Heat Transfer, 43
MAE 5430: Combustion Processes, 102
MAE 5680: Soft Tissue Biomechanics, 111
MAE 5700: Finite Element Analysis for Mechanical and Aerospace Design, 102
MAE 5710: Applied Dynamics, 102, 104
MAE 5770: Engineering Vibrations, 102
MAE 5780: Feedback Control Systems, 102
MAE Undergraduate Coordinator, 101, 129

Major affiliation, 21, 34–35, 134
and academic standing, 154, 158
and international study, 136
after leave of absence, 169

Major honors programs
Biological Engineering (BE), 160–61
Civil Engineering (CE), 161
Computer Science (CS), 162
Electrical and Computer Engineering (ECE), 162
Engineering Physics (EP), 163
Environmental Engineering (EnvE), 163
Independent Major (IM), 164
Information Science, Systems, and Technology (ISST), 164
Materials Science and Engineering (MSE), 164–65
Operations Research and Engineering (OR&E), 165
Science of Earth Systems (SES), 166

Major Information Fair, 26

Majors, requirements checklists
Biological Engineering (BE), 40
Chemical Engineering (ChemE), 45
Civil Engineering (CE), 51
Computer Science (CS), 57
Electrical and Computer Engineering (ECE), 62
Engineering Physics (EP), 66
Environmental Engineering (EnvE), 71
Information Science, Systems, and Technology (ISST), 79
Materials Science and Engineering (MSE), 84
Mechanical Engineering (ME), 89
Operations Research and Engineering (OR&E), 93
Science of Earth Systems (SES), 97

Majors, College of Engineering
choosing, 26
double-Majors, 134–35
graduation requirements, 13, 14–20
handbooks, 24
learning about, 21–25
listed, 14
transferring to another engineering Major, 169
undergraduate consultants and coordinators, 10–12, 23
See also Major affiliation and names of specific majors

Majors, flow charts of
Biological Engineering (BE), 39
Chemical Engineering (ChemE), 44
Civil Engineering (CE), 50
Computer Science (CS), 56
Electrical and Computer Engineering (ECE), 61
Engineering Physics (EP), 65
Environmental Engineering (EnvE), 70
Information Science, Systems, and Technology (ISST), 78
Materials Science and Engineering (MSE), 83
Mechanical Engineering (ME), 88
Operations Research and Engineering (OR&E), 92
Science of Earth Systems (SES), 96
Management Science Option in ISST, 74, 75
Marchewka, Brenda, 10, 11
Margaret Arronet Corbin ’21 Prize, 179
Master of Engineering (M.Eng.) program, 9, 138–39, 174, 175–76
Master of Science (M.S.) program, 174–75
Master Your Future seminar series, 30
Materials Information Society (ASM), 186
Materials Research Society (MRS), 186
Materials Science and Engineering (M.Eng.) program, 175
Materials Science and Engineering (MSE) Major, 14, 81–85
and academic standing, criteria for, 157
affiliation, requirements for, 35
check lists, 84
electives, approved, 82
engineering distributions, 81–82
flow chart, 83
honor society (Alpha Sigma Mu), 183
honors program, 164–65
required major courses, 82
undergraduate consultants and coordinators, 12
Materials Science and Engineering, Department of, 81, 128
Materials Science and Engineering Minor, 100, 128
Materials Science courses, 17
MATH 1910: Calculus for Engineers, 13, 14, 15, 21, 31, 39, 40, 44, 45, 50, 51, 56, 57, 61, 62, 65, 66, 70, 71, 78, 79, 83, 84, 88, 89, 92, 93, 94, 96, 97, 151, 154, 156
MATH 2930: Differential Equations for Engineers, 13, 14, 15, 31, 35, 36, 39, 40, 44, 45, 50, 51, 58, 61, 62, 65, 66, 70, 71, 78, 79, 80, 83, 84, 85, 88, 89, 92, 93, 94, 96, 97, 154, 156
MATH 2940: Linear Algebra for Engineers, 13, 14, 31, 35, 36, 39, 40, 44, 45, 50, 51, 56, 57, 61, 62, 65, 66, 70, 71, 78, 79, 83, 84, 85, 88, 89, 92, 93, 94, 96, 97, 154, 156
MATH 3040: Prove It!, 13, 78, 79, 80, 92, 94
MATH 3110: Introduction to Analysis, 13, 92, 93, 94
MATH 3210: Manifolds and Differential Forms, 103
MATH 3230: Introduction to Differential Equations, 105
MATH 3320: Algebra and Number Theory, 105
MATH 3360: Applicable Algebra, 13, 92, 93, 94, 105
MATH 4200: Differential Equations and Dynamical Systems, 103, 105
MATH 4220: Applied Complex Analysis, 104, 105
MATH 4710: Basic Probability, 103, 105
MATH 4720: Statistics, 118
Mathematical Modeling in Information Technology Area in ISST, 75, 76
Mathematical Models in Management Science Area in ISST, 75
Mathematics, Applied, Minor in, 103–5
Mathematics, Department of, 103, 105
mathematics requirements (for B.S.), 13, 14
Mathematics Support Center, 8
MATLAB-based courses, 15
McManus Design Award, 181
ME. See Mechanical Engineering Major
Mechanical and Aerospace Engineering, Sibley School of, 86, 101, 129
Mechanical Engineering (ME) Major, 14, 86–90
and academic standing, criteria for, 157
affiliation, requirements for, 36
check list, 89
electives, approved, 87
engineering distributions, 86
flow chart, 88
honor society (Pi Tau Sigma), 190
and Minor in Aerospace Engineering, 101
project teams, 23
required major courses, 86–87
undergraduate consultants and coordinators, 12
Mechanical Engineering (M.Eng.) program, 175
Mechanical Engineering Minor, 100, 129–30
Mechanical Engineers, American Society of (ASME), 184
Mechanics courses, 17
medical insurance eligibility, 168
medical school, preparation for, 29, 38
Merck Engineering and Technology Fellowship, 181
Merrill Presidential Scholars Award, 181
Mexico, studying in, 136
Michael W. Mitchell Memorial Award, 181
Minerals, Metals, and Materials Society (TMS), 186
Minority Educational Affairs, Office of, 9
minority students. See Diversity Dinner; Diversity Programs in Engineering; National Society of Black Engineers; Society of Hispanic Professional Engineers; Society of Women Engineers
Minors, Engineering
Business Minor for Engineering Students, 100
listed, 99–100
requirements, 99
See also names of specific Minors
mission and values
of Cornell University, 6
of the College of Engineering Undergraduate Programs, 6–7
Mogensen Prize, 181
Moles Scholarship, 181
Moles Student Award, 181
MRS. See Materials Research Society
MSE. See Materials Science and Engineering Major
MSE 2060: Atomic and Molecular Structure of Matter, 46, 82, 83, 84, 128
MSE 2610: Mechanical Properties of Materials: From Nanodevices to Superstructures, 82, 84, 128
MSE 2620: Electronic Materials for the Information Age, 82, 84, 128
MSE 3010: Materials Chemistry, 82, 83, 84, 128
MSE 3030: Thermodynamics of Condensed Systems, 82, 83, 84, 104, 128
MSE 3040: Kinetics, Diffusion, and Phased Transformations, 82, 83, 84, 128
MSE 3050: Electronic, Magnetic, and Dielectric Properties of Materials, 46, 82, 83, 84, 128
MSE 3070: Materials Design Concepts, 82, 83, 84, 85
MSE 3110: Junior Laboratory I, 82, 83, 84
MSE 3120: Junior Laboratory II, 82, 83, 84
MSE 4020: Mechanical Properties of Materials, Processing, and Design, 82, 83, 84, 128
MSE 4030: Senior Materials Laboratory I, 16, 82, 83, 84, 85
MSE 4040: Senior Materials Laboratory II, 16, 82, 83, 84, 85
MSE 4050: Senior Thesis I, 16, 83, 84, 85
MSE 4060: Senior Thesis II, 16, 83, 84, 85
MSE 4070: Materials Design Concepts II, 82, 83, 84, 85
MSE 4610: Biomedical Materials and Their Applications, 107, 111
MSE 5210: Properties of Solid Polymers, 46
MSE 5240, 46
MSE 5310: Introduction to Ceramics, 46
MSE 5410: Nanofabrication of Semiconductor Devices, 46
MSE 5500: Introduction to Composite Materials, 102
MSE 5620: Biomineralization: The Formation and Properties of Inorganic Biomaterials, 111
MSE undergraduate program director, 128
Mu Sigma Tau, 189

N
name, changing, 171
Nanotechnology Fellowship, 180
National Engineers Week, 22
National GEM Consortium, 176
National Society of Black Engineers (NSBE), 22, 23, 138, 189–90
NAV 3050: Principles of Navigation, 144
NBA 5000: Intermediate Accounting, 116
NBA 5070: Entrepreneurship for Scientists and Engineers, 117
NCC 5560: Managerial Finance, 116
networking, 23, 24
New York State Board for Engineering and Land Surveying, 177
NSBE. See National Society of Black Engineers

O
Office of the Assemblies, 187
Ombudsman, 9
Omega Rho International Honor Society, 190
Operations Research and Engineering (OR&E) Major, 13, 14, 91–94, 135
and academic standing, criteria for, 157
affiliation, requirements for, 36
check lists, 93
electives, 91
engineering distributions, 91
flow chart, 92
honor society (Omega Rho), 190
honors program, 165
required major courses, 91
undergraduate consultants and coordinators, 12
Operations Research and Information Engineering (M.Eng.) program, 175
Operations Research and Information Engineering, School of, 74, 91, 118, 124, 121
Wall Street office, 175
Operations Research and Management Science (OR&MS) Minor, 100, 131
Operations Research and the Management Sciences, Institute for (INFORMS), 189
OR&E. See Operations Research and Engineering Major
OR&E Undergraduate Major Consultant, 118, 124, 131
OR&MS. See Operations Research and Management Science Minor
organizations, student, 183–91
ORIE 3120: Industrial Data and Systems Analysis, 91, 92, 93, 124
ORIE 3150: Financial and Managerial Accounting, 75, 91, 92, 93, 116, 124, 133
ORIE 3200, 78
ORIE 3300: Optimization I, 75, 78, 79, 91, 92, 93, 103, 124, 131
ORIE 3310: Optimization II, 91, 92, 93, 194, 131
ORIE 3500: Engineering Probability and Statistics II, 75, 78, 79, 91, 92, 93, 103, 118, 131
ORIE 3510: Introductory Engineering Stochastic Processes I, 75, 91, 92, 93, 104, 118, 131
ORIE 3800: Information Systems and Analysis, 75, 78, 79
ORIE 4150: Economic Analysis of Engineering Systems, 116, 124
ORIE 4152: Entrepreneurship for Engineers, 117
ORIE 4330: Discrete Models, 76, 104
ORIE 4350: Introduction to Game Theory, 77, 80, 104, 127
ORIE 4520: Introductory Engineering Stochastic Processes II, 104
ORIE 4580: Simulation Modeling and Analysis, 75, 91, 92, 93, 118, 124, 131
ORIE 4710: Applied Linear Statistical Models, 118
ORIE 4711: Experimental Design, 118
ORIE 4712: Regression, 118
ORIE 4740: Statistical Data Mining I, 76
ORIE 4800: Information Technology, 75, 124, 126
ORIE 4810: Delivering OR Solutions with Information Technology, 75, 124, 126
ORIE 4850: Applications of Operations Research and Game Theory to Information Technology, 76, 124, 126
ORIE 4990: Teaching in ORIE, 165
ORIE 4999: ORIE Project, 165
ORIE 5100: Design of Manufacturing Systems, 124
ORIE 5120: Production Planning and Scheduling Theory and Practice, 124
ORIE 5126: Supply Chain Management, 76
ORIE 5550: Applied Time-Series Analysis, 118
ORIE 5600: Financial Engineering with Stochastic Calculus I, 104
ORIE 5610: Financial Engineering with Stochastic Calculus II, 104
ORIE 5770: Quality Control, 118, 124
Orientation Guide, 144–145
Othmer, Donald F., Sophomore Academic Excellence Award, 178

P
PAM 2100: Introduction to Statistics, 133
Paris, Studying in, 136
Paul Hartman Prize, 180
Peer Advisor Program, 26, 190
peer advisors. *See* advising, peer
personal counseling services, 8
Peterson, Nanette, 12
petitions, 16, 26, 167
for credit hours, 144
Petition for Double Major form, 134
Petroleum Geologists, American Association of (AAPG), 183
Philpot, William, 10, 11
PHYS 1116: Physics I: Mechanics and Special Relativity, 45, 51, 57, 62, 65, 66, 79, 84, 89, 93
PHYS 2217: Physics II: Electricity and Magnetism, 45, 51, 57, 62, 65, 66, 71, 79, 84, 89, 93
PHYS 2218: Physics III: Waves and Thermal Physics, 51, 62, 65, 66, 78, 79, 80, 84, 89,
PHYS 3330: Modern Experimental Optics, 65, 67
PHYS 3360: Electronic Circuits
    in Aerospace Engineering Minor curriculum, 102
    in ME Major curriculum, 87, 88, 89, 157
PHYS 4400: Informal Advanced Laboratory, 65, 67
PHYS 4410: Advanced Experimental Physics (Laboratory), 64, 65, 66, 67
physical education requirements, 13, 21
    in BE Major curriculum, 40
    in CE Major curriculum, 51
    in ChemE Major curriculum, 45
    in CS Major curriculum, 57
    in ECE Major curriculum, 62
    in EnvE Major curriculum, 71
    in EP Major curriculum, 66
    in ISST Major curriculum, 79
    in ME Major curriculum, 89
    in MSE Major curriculum, 84
    in OR&E Major curriculum, 93
in SES Major curriculum, 97
and transfer student exemption, 152

physics requirements (for B.S.), 13, 15
Pi Tau Sigma, 190

Policy Notebook for the Cornell Community, 158
Pollack, Lois, 11
Pollock, Clifford, 188
Porter, Nadine, 10, 11
postgraduate education, advising for, 27, 29
prerequisites for Majors, 21
Probability and Statistics courses, 17
Procter and Gamble Technical Excellence Award, 181

professional development services, 9. See also career and professional development; Diversity Programs in Education; Engineering Learning Initiatives
Professional Engineer Examination, 177
Professional Engineer (P.E.) license, 177
Professor James L. Gregg Prize, 180
Programming Contest, 23
projects
electrical and Computer Engineering, 60
PSYCH 2050: Perception, 80, 126
PSYCH 2140: Cognitive Psychology, 80
PSYCH 2800: Introduction to Social Psychology, 80, 126
PSYCH 3300: Introduction to Computational Neuroscience, 110, 123
PSYCH 3420: Human Perception: Applications to Computer Graphics, Art, and Visual Display, 76, 80, 126
PSYCH 3470: Psychology of Visual Communications, 76, 126
PSYCH 3800: Social Cognition, 76, 80, 126
PSYCH 4130: Information Processing: Conscious and Nonconscious, 76, 126
PSYCH 4160: Modeling Perception and Cognition, 77, 80, 126
public (computer) terminals, 171
Public Service Center, 187

R
R. Bolgiano, Sr. Outstanding Teaching Assistant Award, 178
Rand, Richard (Professor), 103
records policy, university student, 33
referreds, 28
Registrar. See Engineering Registrar; University Registrar
registration procedures, 27, 141
research, undergraduate. See Undergraduate Research
Research and Graduate Studies, Office of, 29, 176
residence requirements, 20
resources directory, 8–9
résumé writing, 30, 172, 173
R. N. Janeway Automotive Engineering Award, 180
Robotics (ECE project), 60
Roger K. Berman ’70 Memorial Prize, 178
ROTC courses, 20, 144
Roy, Nicole, 10, 122, 185

S
SAE. See Society of Automotive Engineers
SAE Formula Race, 23
Samuel Garmezy ’13 Prize, 180
SBA. See Social and Behavioral Analysis courses
and academic standing, criteria for, 157
affiliation, requirements for, 36
check lists, 97
engineering distributions, 95
flow chart, 96
honors program, 164
required major courses, 95
specialization courses, 95
undergraduate consultants and coordinators, 12

Science of Earth Systems (SES) Minor, 100, 132
Scientific Computing courses, 17
Scott, Norm (Professor), 188
SES. See Science of Earth Systems Major; Science of Earth Systems Minor
SHPE. See Society of Hispanic Professional Engineers
Shuler, Michael (Professor), 185
Shumway, Fran
Sibley Prizes, 182
Sibley School of Mechanical and Aerospace Engineering, 86, 101, 129
Six-Year Program, 139
SOC 3040: Social Networks and Social Processes, 77, 127
Social and Behavioral Analysis (SBA) courses, 19
in BE Major curriculum, 41
in CE Major curriculum, 53
in ChemE Major curriculum, 47
in CS Major curriculum, 58
in ECE Major curriculum, 63
in EnvE Major curriculum, 72
in EP Major curriculum, 67
in ISST Major curriculum, 80
in ME Major curriculum, 90
in MSE Major curriculum, 85
in OR&E Major curriculum, 94
in SES Major curriculum, 98
Social Systems Area in ISST, 75, 77
Society of Automotive Engineers (SAE), 190
Society of Hispanic Professional Engineers (SHPE), 22, 23, 138, 190–91
Society of Women Engineers (SWE), 22, 23, 138, 191
Solar Decathlon, 23
Spain, studying in, 136
Statistical Science, Department of, 118
Stedinger, Jery (Professor), 184
Stenglein, Christine, 11, 125, 188
STS 2501: Technology in Society, 127
STS 4111: Knowledge, Technology, and Property, 77, 127
Student Activities Fee, 187
Student Assembly, 187
Student Disability Services, 9
Student Employment and Financial Aid, 9
Student Information Card, 153
Student Life Union, 8
student organizations, 183–91
Student Services, Assistant Dean for, 8
student services, 26–33
studying abroad. See international study
Subcommittee on Technical Writing, 16
Suicide Prevention and Crisis Service, 8
S/U grading option, 146–47
summer internships, 24, 173, 176
summer scholars program in engineering, 30
Summer Sessions and Continuing Education, 9, 168
Sundial, The, 23, 26, 29, 143
SWE. See Society of Women Engineers
Sweet, Joseph, 12
swim test requirement, 13, 40, 44, 51, 57, 62, 66, 71, 79, 84, 89, 93, 97, 152
Systems Engineering (M.Eng.) program, 175

T
TA Development Program, 32
TAM 3100: Introduction to Applied Mathematics I, 46, 87, 89, 90, 103, 117
TAM 3110: Introduction to Applied Mathematics, 46, 104, 105
TAM 4550: Introduction to Composite Materials, 102
TAM 5700: Intermediate Dynamics, 102, 104
TAM 5780: Nonlinear Dynamics and Chaos, 104
TAM 6100: Methods of Applied Mathematics I, 104
TAM 6110: Methods of Applied Mathematics II, 104
Tau Beta Pi, 191
Teaching Assistants (TAs), 32
teamwork opportunities, 138
technical writing requirements, 13, 15–16, 136
  in BE Major curriculum, 40, 41
  in CE Major curriculum, 51
  in ChemE Major curriculum, 46
  in CS Major curriculum, 58
  in ECE Major curriculum, 62, 63
  in EnvE Major curriculum, 70, 71
  in EP Major curriculum, 66
  in ISST Major curriculum, 78, 80
  in ME Major curriculum, 89
  in MSE Major curriculum, 84
  in SES Major curriculum, 96, 97
Tel Aviv (Israel), studying in, 136
Theoretical and Applied Mechanics, Department of, 103
Thermodynamics courses, 18
Thomas J. and Jean T. Kelly Prize, 180
Thompson, Michael (Professor), 186
TMS. See Minerals, Metals, and Materials Society
transcripts, 147
transfer credit, 20, 27, 152–53
  for extramural courses, 168
  pros and cons of, 148–49
Transfer Credit Form, 152
transfers
  to another college at Cornell (internal transfer), 9, 170
  to another engineering Major, 169
T. R. Cuykendall Awards, 179
tuition
  for extramural study, 168
  for graduate fellowships, 176
tutorial services, 27
  list of contacts for, 8
  by peer advisors, 26
  providing, 138
Tutors-On-Call, 31
2-1-1 program, 136
U
undergraduate consultants and coordinators, 10–12, 149
undergraduate Majors. See Majors, College of Engineering
Undergraduate Minor Coordinator, 109
Undergraduate Programs, Associate Dean for, 8
Undergraduate Research, 31, 137–38
University Orientation Guide, 144–145
University Registrar, 9
  for name/address changes, 171
  for enrollment information, 32, 33
  for official transcript, 32, 122
  registration process, 141
university student records policy, 33

V
Ve-Sing and Tseng Soo Koo Award, 182
VTBMS 3460: Introductory Animal Physiology, Lectures, 110

W
Walter, Michael, 10, 11
“Weather Phone,” 186
web pages, 24
White, Walter, 186
William Nichols Findley Award, 180
William S. Einwechter Award, 179–80
Williamson, David, 11
withdrawal, 168
women students. See Diversity Programs in Engineering; Society of Women Engineers
Writing-Intensive Co-op, 15, 137
writing-intensive (W-I) engineering courses, 16
Writing Program, 145
writing requirements (for B.S.), 13, 15–16
Writing Workshop, 8, 144
workshops. See Academic Excellence Workshops
Wysocki, Mark, 186

X
Xu, Chris (Professor), 186