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

Beth Howland
Associate 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 10–11) for more specific information. The Major will provide a consultant who can answer specific questions and make binding decisions relating to the fulfillment of degree requirements. Faculty advisors will assist in course selection, but they are not responsible for ensuring that the courses selected meet degree requirements. That is the responsibility of the student.
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University and College Mission, Vision, and Values

Cornell University’s Mission and Values

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

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

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

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

College of Engineering Undergraduate Programs Mission

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

Specific missions are to:

• enroll and graduate a highly qualified and diverse undergraduate student body and enable their success.

• continuously improve the quality of the undergraduate education by ongoing evaluation of the common curriculum, assessment of teaching and learning, and implementation of improvements to the program based on those results.

• infuse the results of ongoing research, the capabilities of technology, the excitement of hands-on learning, and the experience of design projects into the undergraduate curricula.

• provide high-quality information and guidance to undergraduate students about the college, about curricula, and about future employment possibilities.

• oversee the educational progress of all students and encourage and enhance their success, both prior to affiliation with a Major and within the Major.

• collaborate with the faculty and administration of other Cornell colleges and organizations external to Cornell to efficiently provide the best possible undergraduate education.
Vision
Cornell Engineering will utilize the world-class intellectual resources and interdisciplinary opportunities of the college and university to prepare its undergraduate students for lifelong creation of knowledge and solutions to complex real-world problems.

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

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

• apply their general educational experience and specific knowledge of mathematics, science, and engineering to a wide variety of careers including industry, advanced engineering study, nontraditional engineering-related career paths, and graduate study.

• perform in a modern diverse working environment in which they will work in multidisciplinary teams and communicate effectively with both professional colleagues and the public.

• lead design processes that include consideration of the impact designs have on people, societies, and nature.

• model, analyze, and solve complex problems from a systems perspective.

• recognize contemporary global issues and their professional and ethical responsibility to contribute to solutions for the social, economic, and environmental challenges faced by humanity.

• engage in self-directed learning, including the pursuit of graduate study and professional development activities.

Student Learning Outcomes
In terms of their general abilities, our graduates will

1. Have a broad education, including liberal studies.
2. Be proficient in oral and written communication.
3. Be proficient in information literacy, i.e. be able to locate, evaluate, and effectively interpret claims, theories, and assumptions in science and engineering.
4. Have experience with teamwork.
5. Be aware of professional and ethical responsibilities.
In terms of their discipline, students will be well grounded in the mathematical, scientific, and engineering skills that are the basis of their discipline. More specifically, our graduates will have:

1. The ability to design experiments, analyze the data, and interpret the results.
2. The ability to design, model, and analyze engineering systems.
3. The ability to formulate and solve problems.

The ability to use the techniques and tools necessary for the practice of their discipline.

Guide to Important Resources

College of Engineering

Office of the Dean, 242 Carpenter Hall, 255.4326
Associate Dean for Undergraduate Programs, 167 Olin Hall, 255.8240
Assistant Dean for Student Services, 167 Olin Hall, 255.8240
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

Cornell United Religious Work, Anabel Taylor Hall, 255.4214
Counseling and Psychological Services, level one, 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
Let’s Talk Walk-in Service, for hours/locations, go to www.gannett.cornell.edu/CAPS/offsiteSupport.html
Suicide Prevention and Crisis Service, Ithaca, NY 14850, 272.1616 (24 hrs.)

Tutorial and Academic Support Services

Diversity Programs in Engineering, 146 Olin Hall, 255.6403
Engineering Advising, 167 Olin Hall, 255.7414
Engineering Learning Initiatives, 167 Olin Hall, 255.9622
Learning Strategies Center, 420 Computing and Communications Center, 255.6310
Mathematics Support Center, 256 Malott Hall, 255.4658
Office of Undergraduate Biology, 216 Stimson Hall, 255.5233
Physics Tutoring, 115 Rockefeller Hall, 255.6310
Student Disability Services, 4th floor, Computing and Communications Center, 254.4545
Writing Workshop, 174 Rockefeller Hall, 255.6349

Career and Professional Development Services
Cornell Career Services, 103 Barnes Hall, 255.5221
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

Other Resources
Bursar’s Office, 260 Day Hall, 255.6413
Campus Life Management, 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, 120 Day Hall, 255.4680
Office of Minority Educational Affairs (COSEP), 100 Barnes Hall, 255.3841
Office of Workforce Diversity, Equity, and Life Quality, 160 Day Hall, 255.3976
Ombudsman, 118 Stimson Hall, 255.4321
Student Disability Services, 4th floor, Computing and Communications Center, 254.4545
University Registrar, B7 Day Hall, 255.4232, univreg@cornell.edu
Willard Straight Ambassadors, 401 Willard Straight Hall, 255.6839
A faculty member serves as associate director or undergraduate-Major consultant of each Engineering Major. Major consultants can be valuable sources of information for students who want to learn more about their respective undergraduate Majors.

**Undergraduate Major Consultants and Associate Directors**

**Biological Engineering (BE)**
- Michael Walter  
  mfw2@cornell.edu  
  207 Riley-Robb Hall, 255.3161
- Brenda Marchewka  
  bls19@cornell.edu  
  207B Riley-Robb Hall, 255.2173

**Chemical Engineering (ChemE)**
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  tmd10@cornell.edu  
  352 Olin Hall, 255.8715
- Carol Casler  
  cad1@cornell.edu  
  120 Olin Hall, 255.1489

**Civil Engineering (CE)**
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  wdp2@cornell.edu  
  453 Hollister Hall, 255.0801
- Nadine Porter  
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  221 Hollister Hall, 255.3412

**Computer Science (CS)**
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  4153 Upson Hall, 255.1372
- Nicole Roy  
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**Electrical and Computer Engineering (ECE)**
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  332 Rhodes Hall, 254-5128
- Sandi Goodwin  
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  222 Phillips Hall, 255.4309

**Engineering Physics (EP)**
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  206 Clark Hall
- Kelli Hulslander  
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**Environmental Engineering (EnvE)**
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  221 Hollister Hall, 255.3412
- Brenda Marchewka  
  bls19@cornell.edu  
  207B Riley-Robb Hall, 255.2173
<table>
<thead>
<tr>
<th>Department</th>
<th>Name</th>
<th>Email</th>
<th>Office Location</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Major (IM)</td>
<td>Associate Dean</td>
<td>David Gries</td>
<td><a href="mailto:crp5@cornell.edu">crp5@cornell.edu</a></td>
<td>167 Olin Hall, 255.8240</td>
</tr>
<tr>
<td></td>
<td>Cindy Pakkala</td>
<td><a href="mailto:gries@cs.cornell.edu">gries@cs.cornell.edu</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information Science, Systems, and Technology</td>
<td>Paul Ginsparg</td>
<td><a href="mailto:ginsparg@cornell.edu">ginsparg@cornell.edu</a></td>
<td><a href="mailto:cms242@cornell.edu">cms242@cornell.edu</a></td>
<td>303 Upson Hall, 255.9837</td>
</tr>
<tr>
<td>(ISST)</td>
<td>Christine Stenglein</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td>203 Rhodes Hall, 255.5088</td>
</tr>
<tr>
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<td><a href="mailto:spb14@cornell.edu">spb14@cornell.edu</a></td>
<td><a href="mailto:mmc2@cornell.edu">mmc2@cornell.edu</a></td>
<td>214 Bard Hall, 255.9159</td>
</tr>
<tr>
<td></td>
<td>Michele Conrad</td>
<td>329 Thurston Hall, 255.6679</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering (ME)</td>
<td>Elizabeth Fisher</td>
<td><a href="mailto:emf4@cornell.edu">emf4@cornell.edu</a></td>
<td><a href="mailto:np18@cornell.edu">np18@cornell.edu</a></td>
<td>108 Upson Hall, 255.3573</td>
</tr>
<tr>
<td></td>
<td>Nanette Peterson</td>
<td>289 Grumman Hall, 255.8309</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations Research and Engineering (ORE)</td>
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</tr>
<tr>
<td></td>
<td>Cindy Jay</td>
<td>235 Rhodes Hall, 255-5360</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science of Earth Systems (SES)</td>
<td>Natalie Mahowald</td>
<td><a href="mailto:nmm63@cornell.edu">nmm63@cornell.edu</a></td>
<td><a href="mailto:ss376@cornell.edu">ss376@cornell.edu</a></td>
<td>2124 Snee Hall, 255.5466</td>
</tr>
<tr>
<td></td>
<td>Savannah Sawyer</td>
<td>2140 Snee Hall, 255.5166</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Requirements for the Bachelor of Science Degree

<table>
<thead>
<tr>
<th>Category</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mathematics</td>
<td>15–16</td>
</tr>
<tr>
<td>MATH 1910, 1920, 2930 or 2940, and a mathematics course chosen by the Major.</td>
<td></td>
</tr>
<tr>
<td>2. Physics</td>
<td>8–12</td>
</tr>
<tr>
<td>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 ORE 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.</td>
<td></td>
</tr>
<tr>
<td>3. Chemistry</td>
<td>4–8</td>
</tr>
<tr>
<td>CHEM 2090. Majors in ChemE 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.</td>
<td></td>
</tr>
<tr>
<td>4. First-year writing seminars (two courses)</td>
<td>6</td>
</tr>
<tr>
<td>5. Technical writing requirement (see page 14)</td>
<td>3</td>
</tr>
<tr>
<td>6. Computing (CS 1110, 1112, or 1114 followed by CS 1130 or CS 1132)</td>
<td>5</td>
</tr>
<tr>
<td>7. Engineering distribution</td>
<td></td>
</tr>
<tr>
<td>a. one introduction to engineering (ENGRI) course</td>
<td>3</td>
</tr>
<tr>
<td>b. two distribution courses (ENGRD), one of which may be required by the Major</td>
<td>6</td>
</tr>
<tr>
<td>8. Liberal studies distribution (six courses)</td>
<td>18</td>
</tr>
<tr>
<td>9. Approved electives (two courses)</td>
<td>6</td>
</tr>
<tr>
<td>10. Major program</td>
<td></td>
</tr>
<tr>
<td>a. Major-required courses</td>
<td>≥30</td>
</tr>
<tr>
<td>b. Major-approved electives</td>
<td>9</td>
</tr>
<tr>
<td>c. Courses outside the Major</td>
<td>9</td>
</tr>
</tbody>
</table>

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 (ORE)
Science of Earth Systems (SES)

Requirements for Graduation

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

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

Category 1. Mathematics
Students must earn at least C– in MATH 1910, 1920, 2930 or 2940, and a math course chosen by the Major. Students who do not meet this requirement the first time 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 withdrawal from the engineering program.) Courses taken a second time to meet this requirement do not yield additional credit toward a degree.

Category 2. Physics
Students must earn at least C– in MATH 1910 before taking PHYS 1112. Similarly, at least
C– is required in each subsequent math course before taking the physics course for which it is a prerequisite (MATH 1920 is a prerequisite for PHYS 2213; MATH 2930 is a prerequisite 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 2090–2080 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.

Category 4. Computing
Introduction to Computing (one of CS 1110, 1112, and 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 is MATLAB-based, and vice versa. The second course should be completed by the end of the second year.

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

Category 5. First-Year Writing Seminars
During each semester of the first year, students must choose a first-year writing seminar from among more than 100 courses offered by more than 30 different departments throughout Cornell.

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

Category 6. Technical Writing
In addition to the first-year writing seminars, a technical writing course must be taken as an engineering distribution, liberal studies, approved elective, or Major course. 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
   BEE 4730: Watershed Engineering with co-registration in BEE 4930: Technical Writing for Engineers
   BEE 4890: Entrepreneurial Management for Engineers
   CHEME 4320: Chemical Engineering Laboratory
   MAE 4272: Fluids/Heat Transfer Laboratory
   MSE 4030/4040 (both): Senior Materials Laboratory I and II
   MSE 4050/4060 (both): Senior Thesis I and II
4. ENGRC 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 engineering. It may be appropriate to submit a petition to the CCGB’s Subcommittee on Technical Writing for permission to use their upcoming writing (not past writing) to meet the technical-writing requirement.

Category 7. Engineering Distribution
The Common Curriculum requires three distribution courses (9 credits). One intro-to-engineering course (with the course acronym ENGRI) is to be completed during the first year. The remaining two distribution courses (with the course acronym ENGRD) should be completed by the end of the third semester. Some Majors may require additional distribution courses, taken after a student affiliates with a Major. Common Curriculum distribution requirements must be fulfilled by the end of the second year.

The intro-to-engineering course introduces students to the engineering process and provides a substantive experience in open-ended problem-solving. The following courses fulfill this requirement:

   ENGRI 1100: Lasers and Photonics
   ENGRI 1101: Engineering Applications of Operations Research
   ENGRI 1110: Nanotechnology
   ENGRI 1120: Introduction to Chemical Engineering
   ENGRI 1130: Water Treatment Design
   ENGRI 1140: Materials: Enabling the Future of Energy
   ENGRI 1160: Modern Structures
   ENGRI 1170: Introduction to Mechanical Engineering
   ENGRI 1180: Design Integration: DVDs and iPods
   ENGRI 1190: Biomaterials for the Skeletal System
   ENGRI 1200: Introduction to Nanoscience and Nanoengineering
   ENGRI 1220: Earthquake!
   ENGRI 1260: Introduction to Signals and Telecommunications
   ENGRI 1270: Introduction to Entrepreneurship and Enterprise Engineering
   ENGRI 1280: Security, Privacy, and Information Network Design: Wiretaps to Facebook
   ENGRI 1290: Energy: From Atoms to Zephyrs
ENGRI 1310: Introduction to Biomedical Engineering
ENGRI 1610: Computing in the Arts
ENGRI 1670: Visual Imaging in the Electronic Age

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

1. Scientific Computing
   ENGRD 2110: Object-Oriented Programming and Data Structures
   ENGRD 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

The Academic Program
8. Biology and Chemistry

- BIOG 1101 and 1103: Biological Sciences, Lectures and Laboratory
- BIOG 1105: Introductory Biology
- BIOG 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. At least six courses (totaling at least 18 credits) are required, and these should be chosen with as much care and foresight as courses from technical areas.

- The six courses must be chosen from at least three of the following seven groups
- One course may be chosen from Group 7 (CE).
- At least two courses must be at the 2000 level or higher.

Students should utilize the current Courses of Study as the master list of approved Liberal Studies courses. Refer to the web page of Cornell Engineering Advising (www.engineering.cornell.edu/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
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) (FL)**

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

**Group 7. Communications in Engineering (CE)**

Courses in this area explore communication as a way of acting in the world. The primary aim is to provide students with the opportunity to practice performing a range of engineering-related communication skills within specific genres (e.g., proposals, reports, and journal articles, oral presentations, etc.). Each of these genres potentially engages a wide variety of audiences and, depending on the particulars of context, each may have multiple purposes. The secondary aim is to enable students to be aware of the choices they make as communicators and to be able to articulate a rationale for those choices. (Only one course will be allowed to be counted in this category.)

**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 as they wish, in addition to the minimum engineering curriculum requirement, before meeting graduation requirements.

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

Category 10. Major requirements
The requirements of the Majors are discussed on pages 28–83. 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.

Residents 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, and CS 1114;
- Two first-year writing seminars;
- One intro-to-engineering course (ENGRI designation);
- Two 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 26–27 of this handbook and in Courses of Study.
Academic Advising and Student Services

Engineering Advising Office

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 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 email newsletter for students that provides information about upcoming deadlines and special programs; organizing the Major Information Fair and other events to help 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

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 courses to be used as approved electives. 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 necessary changes in course enrollment. Students should 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 most useful when they come from people who know the student well enough to accurately assess their capabilities.

What to Expect from an 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, study abroad, employment, or graduate school.

• **Availability.** Students should expect to have ready access to their advisors. Most advisors set aside several hours each week for advising and will usually make appointments outside those hours if necessary. 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 Not to Expect from an 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. However, they will 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 advisor and 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.

Peer Advising

Each ENGRG 1050 (Engineering Seminar) section has one or two peer advisors: second-, third-, or 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 email their peer advisors when they have questions.

Preprofessional Advising

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

Premedical

Students interested in medicine or other health-related careers must plan their courses early to meet both the requirements of the Common Curriculum and the prerequisites of the intended professional course of study. Engineering Advising helps students understand how professional course requirements fit into the Engineering curriculum. The university health career advisor (103 Barnes Hall) assists students in navigating the examination and application processes related to health careers. For additional information, please see: http://www.career.cornell.edu.

Prelaw

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

Students interested in business may wish to consider the minor in Business (specifically for Engineering students) offered by the Department of Applied Economics and Management (AEM) in the College of Agriculture and Life Sciences (CALS). Information about this minor can be obtained by visiting Engineering Advising.

Students may also wish to consider special cooperative programs between the College of Engineering and the Johnson Graduate School of Management, which allow students to work on degrees in both areas at the same time. For more information, contact the Engineering Research and Graduate Office, 222 Carpenter Hall, and the admissions office of the Johnson Graduate School of Management, 112 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 coordinates and plans educational, professional development, and networking opportunities that enhance interaction and learning across groups. For further information, please contact DPE at 255.6403 or stop by 146 Olin Hall.

Engineering Learning Initiatives

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

Academic Excellence Workshop (AEW)

AEWs are optional 1-credit, small-group, collaborative-learning sessions that complement the core engineering courses, including the core MATH, CHEM, and CS courses. The weekly two-hour workshops, led by trained peer facilitators, offer a cooperative environment where students work together to enhance understanding of course material. Research shows that such cooperative methods promote higher grades, deeper comprehension, more enjoyment in learning, and more positive attitudes toward academic work. For more information on AEWs, visit www.engineering.cornell.edu/aew/.

Tutors-on-Call

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

**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 it processes all grade and course updates. Official documents relating to academic matters are filed as part of each student’s permanent record and held there. It 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) as directory information that may be released unless a student submits a “no-release” request to the University Registrar. Additionally, where the university believes that it is in a dependent student’s best interest, information from the student’s educational records may, at the university’s discretion, be released to the parents or legal guardians of a dependent student. Such disclosure will generally be limited to information about a student’s official status at the university, but parents or legal guardians of a dependent student may also be notified when a student has voluntarily withdrawn from the university or has been required to withdraw; when a student has been placed on academic warning; when the student’s academic good standing or promotion is at issue; when a student has been placed on disciplinary probation or restriction; or when a student otherwise engages in behavior calling into question the appropriateness of the student’s continued enrollment in the university. Unless otherwise indicated in writing by the student at the time of registration, or thereafter, the university will presume that a full-time undergraduate student is a dependent as that term is defined in the Internal Revenue Code.
Applying for Major Affiliation

Students 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 list below).

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 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*. The descriptions of these programs begin on page 28. 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 courses that constitute the Major; they must earn grades that are adequate to remain in good standing (see page 124 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 their Major. Specific Major requirements are set forth later in this handbook and in *Courses of Study*. Students should consult their undergraduate Major consultants (listed on pages 10-11) and their faculty advisors if they have questions regarding the requirements.

Requirements for Major Affiliation

**Biological Engineering (BE)**

Minimum GPA of $\geq 2.5$ and at most one grade below C– in math, science, and engineering courses. Completion of BEE/ENGRD 2600 or 2510 with a C- or higher, and one year of Introductory Biology with grades of C- or higher. Completion of all College of Engineering core requirements by the end of the sophomore year (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 $\geq 2.2$ 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.

Computer Science (CS)
At least C in all completed CS and math courses. GPA ≥2.5 in CS 2110 and 2800. GPA ≥2.5 in MATH 1920 and CS 2800. Visit the CS undergraduate web site 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, and ECE/ENGRD 2300. GPA ≥2.5 in the following courses if completed: MATH 1920, 2930, 2940; PHYS 2213; ECE/ENGRD 2100; ECE 2200; ENGRD/CS 2110, ECE/ENGRD 2300.

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

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

Independent Major (IM)
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 completed math, ENGRD, and ISST Major courses. Qualifying courses must be taken at Cornell, and for a letter grade. For a repeated course, the most recent grade is used.

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

Mechanical Engineering (ME)
At least C– in ENGRD 2020, ENGRD 2210 (if taken), and 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 (ORE)
At least C in ENGRD 2700 and MATH 2940. GPA ≥2.2 in math, science, and engineering courses (both overall and in the term immediately before affiliation). At least C– in all completed ORIE courses. Good academic standing in the college.

Science of Earth Systems (SES)
GPA ≥2.0 in all math, science, and engineering courses. Good academic standing in the college.
Major Programs

Each Major program is described using a chart that depicts when courses are usually taken: The charts do not include Liberal Studies and Physical Education requirements.

Major: Biological Engineering (BE)

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

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

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

Engineering Distributions
ENGRD 2020: Mechanics of Solids (required)
ENGRD 2XXX: ENGRD 2600: Principles of Biological Engineering (recommended)

Required Major Courses
Choose two of the three following:
BIOMG 1350: Principles of Cell and Developmental Biology
BLOG 1440: Introduction to Comparative Physiology
BIOEE 1610: Ecology and the Environment
plus
BLOG 1500: Investigative Biology Laboratory
or
BLOG 1105/1106: Introductory Biology
or
BLOG 1107/1108: Introductory Biology
or
BIOMG 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) with a biology prerequisite
CHEM 1570: Introduction to Organic and Biological Chemistry
or
CHEM 3570: Organic Chemistry for the Life Sciences
BEE 1510, 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. The Intro Biology requirement may be satisfied by either of the following two options: (1) Take any two of: BIOG 1350, BIOG 1440, BIOG 1610; plus one semester of BIOG 1500 (lab), or (2) BIOG 1105 and BIOG 1106 or BIOG 1107 and BIOG 1108.
d. Either Biochemistry or Microbiology is required: BIOMG 3300, or BIOMG 3330, or BIOMG 3310 and BIOMG 3320, or BIOMI 2900, or CEE 4510.
e. BEE1510 and BEE1200 required of CALS matriculates. CS111x and ENGRI required of CoE matriculates.
f. Upper level BIO: Any biology course that has a biology prerequisite.
g. CALS matriculates must enroll in CHEM 2070 (fall); COE matriculates must enroll in CHEM 2090 (fall, spring).
### Biological Engineering Major Check List

<table>
<thead>
<tr>
<th>Course/Requirement</th>
<th>Min. Cr. Hrs.</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>
<td>❑</td>
</tr>
<tr>
<td>MATH 2940</td>
<td>4</td>
<td>❑</td>
</tr>
<tr>
<td>CHEM 2090 or CHEM 2070&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4</td>
<td>❑</td>
</tr>
<tr>
<td>CHEM 1570 (or 3570)</td>
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<td>❑</td>
</tr>
<tr>
<td>PHYS 1112</td>
<td>4</td>
<td>❑</td>
</tr>
<tr>
<td>PHYS 2213</td>
<td>4</td>
<td>❑</td>
</tr>
<tr>
<td>BEE 1510, CS 1110, CS 1112, or CS 1114</td>
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</tr>
<tr>
<td>CS 1130 or 1132</td>
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<td>❑</td>
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<td>Intro BIO&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>❑</td>
</tr>
<tr>
<td>BIOG 1500&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2</td>
<td>❑</td>
</tr>
<tr>
<td>BIOMG 3300 or 3330 or BIOMI 2900 or CEE 4510</td>
<td>4/3</td>
<td>❑</td>
</tr>
<tr>
<td>BIO XXXX (upper-level biology)</td>
<td>3/4</td>
<td>❑</td>
</tr>
<tr>
<td>First-Year Writing Seminar 1&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3</td>
<td>❑</td>
</tr>
<tr>
<td>First-Year Writing Seminar 2</td>
<td>3</td>
<td>❑</td>
</tr>
</tbody>
</table>

**Liberal Studies Distribution**—six courses (18-credit minimum)

| Liberal Studies 1 | ❑ |
| Liberal Studies 2 | ❑ |
| Liberal Studies 3 | ❑ |
| Liberal Studies 4 | ❑ |
| Liberal Studies 5 | ❑ |
| Liberal Studies 6 | ❑ |

**Approved Elective 1** (two courses; 6-credit minimum) | 3 | ❑ |

**Physical Education** (two semesters) and swim test | 0 | ❑ |

**Required Major Courses** (46-credit minimum)

### Introduction to Engineering (not required of CALS–matriculating BE students who complete BEE 1510 and BEE 1200)<sup>d</sup>

| ENGRG 1050 or BEE 1200<sup>f</sup> | 0/1 | ❑ |
| BEE 3500 | 3 | ❑ |
| BEE 2220 or ENGRD 2210 | 3 | ❑ |
| CEE 3040 or ENGRD 2700<sup>e</sup> | 4/3 | ❑ |
| BEE 3310 or CEE 3310 | 4 | ❑ |

**Major Concentration Elective<sup>g</sup>** | 3 | ❑ |

**Major-approved Engineering Electives<sup>e</sup>** | 12–17 | ❑ |

**Total Required Credits** | 127 minimum | ❑ |

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

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<sup>a</sup>: CHEM 2070 replaces CHEM 2090 effective Fall 2016.
<sup>b</sup>: BIOG 1500 replaces BIOG 1510.
<sup>c</sup>: All Writing Seminars can be taken in the first year, and the second seminar can be taken in the summer.
<sup>d</sup>: Required of CALS–matriculating BE students who complete BEE 1510 and BEE 1200.
<sup>e</sup>: Engineering Distribution courses with the same course number count as electives.
<sup>f</sup>: BEE 1200 was replaced by ENGRG 1050 effective Fall 2016.
<sup>g</sup>: Major concentration electives are courses other than those listed above that contribute to the major concentration.
Notes

a. COE matriculates must enroll in CHEM 2090 (fall, spring); CALS matriculates must enroll in CHEM 2070 (fall)

b. Choose two of the three following: BIOG 1350, BIOG 1440, or BIOG 1610, plus BIOG 1500. May substitute BIOG 1105/1106 or BIOG 1107/1108. All BIO courses must be taken for letter grade.

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.

d. BE satisfies the intro-to-engineering course and credit requirement through a sequence of courses in the Major. An ENGR1 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. First-year 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: Career Perspectives
CHEME 3130: Chemical Engineering Thermodynamics
CHEME 3230: Fluid Mechanics
CHEME 3240: Heat and Mass Transfer
CHEME 3320: Analysis of Separation Processes
CHEME 3720: Introduction to Process Dynamics and Control
CHEME 3900: Chemical Kinetics and Reactor Design
CHEME 4320: Chemical Engineering Laboratory
CHEME 4620: Chemical Process Design

Electives
Two advanced chemical engineering electives chosen from:
CHEME 4010: Molecular Principles of Biomedical Engineering
CHEME 4020: Cellular Principles of Biomedical Engineering
CHEME 4700: Process Control Strategies
CHEME 4720: Feedback Control Systems
CHEME 4800: Chemical Processing of Electronic Materials
CHEME 4810: Biomedical Engineering
CHEME 4840: Microchemical and Microfluidic Systems
CHEME 5430: Biomolecular Engineering of Bioprocesses
CHEME 6240/MAE 5240: Physics of Micro- and Nanoscale Fluid Mechanics and Heat Transfer
CHEME 6310: Engineering Principles for Drug Delivery
CHEME 6400: Polymeric Materials
CHEME 6440: Aerosols and Colloids
CHEME 6610: Air Pollution Control
CHEME 6640: Energy Economic
CHEME 6650: Energy Engineering

Four Major-approved electives (includes the biology elective)
Chemical Engineering Major (ChemE)

a. This is a major-approved elective.
b. May be taken in semester 7 or 8.
c. The biology requirement can be taken in semester 4 or later.
Chemical Engineering 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>
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<tr>
<td>MATH 1920</td>
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<tr>
<td>MATH 2930</td>
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<tr>
<td>MATH 2940 (or CEE 3040 or ENGRD 2700)</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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<tr>
<td>PHYS 2213 (or 2217)</td>
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<tr>
<td>CS 1110 (or 1112, or 1114)</td>
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<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 2190</td>
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<tr>
<td>Engineering Distribution 2: CHEM 3890 (recommended)(^a)</td>
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<tr>
<td>First-Year Writing Seminar 1(^e)</td>
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<tr>
<td>First-Year Writing Seminar 2(^e)</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 6</td>
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<tr>
<td>Approved Elective 1: CHEM 2080 (2160) (two courses; 6-credit minimum)</td>
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<td>Approved Elective 2(^d)</td>
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<td>Physical Education (two semesters and swim test)</td>
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<td><strong>Required Major Courses (52-credit minimum)(^f)</strong></td>
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<td>CHEME 3010</td>
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<td>CHEME 3130</td>
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<td>CHEME 3900</td>
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<td>CHEME 4320(^e)</td>
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<td>Advanced CHEME Elective 2(^g)</td>
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<td>Courses outside the Major:</td>
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<td>CHEM 2510</td>
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<td>CHEM 3900(^b)</td>
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<td>Major-approved Elective 2: Advanced Science Elective(^e)</td>
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<td>Major-approved Elective 3(^g)</td>
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<tr>
<td>Major-approved Elective 4(^g)</td>
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</tr>
</tbody>
</table>

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. Each 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 (fall, 3 credits).
   • Eight credits of a pre-med biology sequence; BIOG 1500: Investigative Laboratory (academic year, 2 credits) and BIOG 1350: Principles of Cell Developmental Biology (academic year, 3 credits) and BIOG 1440: Introduction to Comparative Physiology (academic year, 3 credits) or BIOG 1610: Ecology and the Environment (academic year, 3 credits), BIOG 1105: Introductory Biology (fall, 4 credits) and BIOG 1106: Introductory Biology (spring, 4 credits), BIOG 1107: General Biology (summer, first half of eight-week session, 4 credits) and BIOG 1108: General Biology (summer, second half of eight-week 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—BIOMG 3300: Principles of Biochemistry, Individual Instruction (fall or spring, 4 credits) or BIOMG 3330: Principles of Biochemistry: Proteins, Metabolism, and Molecular Biology (six-week summer session, 4 credits).
   • five credits of biochemistry—BIOMG 3310: Principles of Biochemistry: Proteins and Metabolism (fall, 3 credits) and BIOMG 3320: Principles of Biochemistry: Molecular Biology (spring, 2 credits).

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

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 (CHEME 4320: Chemical Engineering Laboratory satisfies this requirement).

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

g. Students who want a biomolecular focus should use the following courses as electives: CHEME 4010 and CHEME 4020 as advanced chemical engineering electives, BIOMG 3300 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 visit www.cheme.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, 255.3412, www.cee.cornell.edu

**Program Objectives**

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

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

**Engineering Distributions**

ENGRD 2020: Mechanics of Solids (required)

**Recommended Distributions**

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

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

ENGRD 2510: Engineering 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 4780b: Structural Dynamics and Earthquake Engineering

ENGRD 3200a: Engineering Computation

CEE 3040a, c: Uncertainty Analysis in Engineering

CEE 3230: Engineering Economics and Management

CEE 3310: Fluid Mechanics

CEE 3410: Introduction to Geotechnical Engineering

CEE 3510d: Environmental Quality Engineering

CEE 3610d: Introduction to Transportation Engineering

CEE 3710: Structural Modeling and Behavior
Electives
Technical writing course (see listing of approved courses in *Courses of Study*)
One CEE Capstone Design course
Two CEE design courses
Two Major-approved electives
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. 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. Recommended: ENGRD 2610 for Infrastructure; ENGRD 2210 for Hydraulics; ENGRD 2110 for Transportation; ENGRD 2510 for Environmental.
h. ENGRD 3200 may be taken in semester 4 or 6.
i. If the technical communication requirements are met with a course that fulfills another requirement, then an additional advisor approved elective is required.
### Civil Engineering Major Check List

<table>
<thead>
<tr>
<th>Course Details</th>
<th>Credit Hours</th>
<th>√ When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimum Credit Hours</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH 1910</td>
<td>4</td>
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<tr>
<td>MATH 1920</td>
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<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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<td>PHYS 1112 (or 1116)</td>
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<td>PHYS 2213 (or 2217)</td>
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<tr>
<td>PHYS 2214 (or 2218 or CHEM 2080 or 1570)</td>
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<td>CS 1110 (or 1112, or 1114)</td>
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<tr>
<td>CS 1130 (or 1132)</td>
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<tr>
<td>Introduction to Engineering (ENGRI 1XXX)</td>
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<td>Engineering Distribution 1: ENGRD 2020 (required)</td>
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<tr>
<td>Engineering Distribution 2</td>
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<td>First-Year Writing Seminar 1</td>
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<tr>
<td>First-Year Writing Seminar 2</td>
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<td></td>
</tr>
<tr>
<td>Liberal Studies Distribution—6 courses (18-credit minimum)</td>
<td>18</td>
<td></td>
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<tr>
<td>Liberal Studies 1</td>
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<tr>
<td>Liberal Studies 6</td>
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<td>Approved Elective (two courses; 6-credit minimum)</td>
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<tr>
<td>Approved Elective 1</td>
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<tr>
<td>Approved Elective 2</td>
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<tr>
<td>Physical Education (two semesters) and swim test</td>
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<tr>
<td><strong>Required Major Courses (49-credit minimum)</strong></td>
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<tr>
<td>ENGRD 2030&lt;sup&gt;a&lt;/sup&gt; or CEE 4780&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td>ENGRD 3200&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>CEE 3040&lt;sup&gt;a,c&lt;/sup&gt;</td>
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<td>CEE 3610&lt;sup&gt;d&lt;/sup&gt;</td>
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<td>Technical Writing Course&lt;sup&gt;e,h&lt;/sup&gt;</td>
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<td>CEE Capstone Design Elective 1&lt;sup&gt;f&lt;/sup&gt;</td>
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<td>Major-approved Elective 1&lt;sup&gt;f&lt;/sup&gt;</td>
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<td>Major-approved Elective 2&lt;sup&gt;f&lt;/sup&gt;</td>
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<tr>
<td><strong>Total Required Credits</strong></td>
<td>126 minimum</td>
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</tr>
<tr>
<td>Additional Elective Courses (0 credits minimum, no maximum)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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: Introduction to the Behavior of Metal Structures. However, CEE 3720 or CEE 4710 then counts as a Core Course only and not as a CEE Design Course or 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 3200 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. 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 (CS)**
Offered by: Department of Computer Science
303 Upson Hall, 255.0982, www.cs.cornell.edu/degreeprogs/ugrad/

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

**Engineering Distributions**
ENGRD 2110: Object-Oriented Programming and Data Structures (required)

**Required Major Courses**
CS 2800: Discrete Structures
CS 3110: Data Structures and Functional Programming
CS 3410: Computer System Organization and Programming
or
CS 3420/ECE 3140: Computer Organization
CS 4410: Operating Systems
CS 4820: Introduction to Analysis of Algorithms

**Electives**
Three CS electives numbered ≥4000; 3-credit minimum per course; CS 4999 not allowed
One CS project course; 2-credit minimum
Three Major-approved technical electives numbered ≥3000; 3-credit minimum per course
Major-approved, free elective; totaling 3 credits
Two advisor-approved, free electives
Three related, upper-level elective courses numbered ≥3000 (external specialization); 3-credit minimum per course; CS courses not allowed
Computer Science Major (CS)

a. 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 111x, 113x, 2110, 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.
<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>√ When Done</th>
</tr>
</thead>
<tbody>
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<td>MATH 1910</td>
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<td>MATH 1920</td>
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<td>MATH 1112 (or 1116)</td>
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<td>First-Year Writing Seminar 1&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>CS 4820</td>
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<td>CS 4000 or above Elective 3&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>Major-approved Technical Elective 2&lt;sup&gt;d&lt;/sup&gt;</td>
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<td>Major-approved Technical Elective 3&lt;sup&gt;d&lt;/sup&gt;</td>
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<tr>
<td>Major-approved Free Elective&lt;sup&gt;e&lt;/sup&gt;</td>
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</tr>
</tbody>
</table>

Total Required Credits 122 minimum

Additional Elective Courses<sup>f,g</sup> (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. All CS 4000+ Electives must be taken under the CS rubric. CS 3810 and CS/ENGRD 3220 also accepted unless CS 4210/MATH 4250 applied. CS 4999 NOT allowed.

c. The External Specialization consists of 9 or more credits ≥ 3000 level. Courses not allowed in the External Specialization are: any CS course, LING 4474, INFO 4302, INFO 3300, INFO 4300, and INFO 5300. The three courses must be related to each other (3-credit minimum per course).

d. Three 3000+ level courses (including ENGRD 2700 or MATH 2930, but not both) that are technical in nature, as determined by the Major.

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

f. Additionally, students’ course selections must satisfy the requirements of at least one “vector”, or CS-centric specialization, defined by the department. The set of vectors at the time of this writing include artificial intelligence, computational science and engineering, data-intensive computing, graphics, human-language technologies, network science, programming languages, security and trustworthy systems, software engineering/code warrior, systems, theory, and a broad “Renaissance” vector. See www.cs.cornell.edu/ugrad for the requirements of each vector.

g. Students’ course selections must also include one of BTRY 4080, CS 4850, ECE 3100, ECON 3190, ENGRD 2700, MATH 4710. CS Majors can use ECE 3100 as a substitute for ENGRD 2700 in satisfying the engineering distribution requirements.

All the Major electives described above must be courses of at least 3 credits with the exception of the CS project course, which is at least 2 credits, or as otherwise specified.

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/degreeprogs/ugrad/).
Major: Electrical and Computer Engineering (ECE)

Accredited by ABET (see inside front cover)
Offered by: School of Electrical and Computer Engineering
222 Phillips Hall, 255.4309, 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, but not required, 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 2400: Introduction to Design for Electrical and Computer Engineers

Further Major Requirements
At least three of four ECE foundation courses: ECE 3030, ECE 3100, ECE 3140, ECE 3150
At least one Culminating Design Experience course (see below)
At least three additional ECE courses numbered ≥ 4000. Each of these courses must have at least one ECE foundation course as a pre-requisite, and the list of all the pre-requisites of these three courses must include at least three distinct ECE foundation courses.
At least three additional ECE courses at the 3000-level or above
At least nine credits of Outside-ECE technical electives
At least one course taken under Engineering Distribution or Further Major Requirements
must satisfy the ECE probability and statistic requirement and at least one course taken under Engineering Distribution or Further Major Requirements must satisfy the ECE advanced programming requirement.

The minimum number of Major credits is currently 55. The ECE Undergraduate Handbook site (www.ece.cornell.edu/ugradhndbk) provides additional details.

**Culminating Design Experience (CDE)**
A Culminating Design Experience (CDE) course includes a significant and open-ended engineering design assignment with realistic constraints. The principal goal of a CDE course is to help students develop the ability to design a component, system, or process to meet desired needs taking into account some or all of the following: economics, the environment, sustainability, manufacturability, ethics, health and safety, society, and politics. A current list of CDE courses is posted on the bulletin board outside 222 Phillips Hall. CDE courses for 2010–2011 are ECE 4150: GPS, Theory and Design; ECE 4370: Fiber and Integrated Optics; ECE 4530: Analog Integrated Circuit Design; ECE 4750/CS 4220: Computer Architecture; and ECE 4760: Digital Systems Design Using Microcontrollers.

**Projects**
Students may count up to three credits of work on approved large-group interdisciplinary project teams in the Outside-ECE Technical Electives category. A current list of approved project teams appears on the ECE Undergraduate Handbook site (www.ece.cornell.edu/ugradhndbk). Students may also petition to count up to three independent-study credits (course numbers ECE 3910, 3920, 4910, or 4920) in the Outside-ECE Technical Elective category. See the ECE Undergraduate Handbook site for rules governing such work.
Electrical and Computer Engineering Major (ECE)

a. At least 3 of ECE 3030, 3100, 3140, and 3150 must be taken.
b. Culminating Design Experience. Consult the ECE Undergraduate Office for options.
Electrical and Computer Engineering Major Check List

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
<th>√ When Done</th>
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</thead>
<tbody>
<tr>
<td>MATH 1910</td>
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<tr>
<td>MATH 1920</td>
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<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 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>
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<td>PHYS 2214 or 2218</td>
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<tr>
<td>CS 111x</td>
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<tr>
<td>CS 113x</td>
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<tr>
<td>Intro to Engineering (ENGRI 1XXX)</td>
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<tr>
<td>Engineering Distribution 1: ECE/ENGRD 2300</td>
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<tr>
<td>Engineering Distribution 2: ECE/ENGRD XXXX</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>
<td>First-Year Writing Seminar 2&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>Liberal Studies Distribution—six courses (18-credit minimum)</td>
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<td>Liberal Studies 1</td>
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<td>Liberal Studies 2</td>
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<td>Approved Elective 1 (two courses, 6-credit minimum)</td>
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<td>Approved Elective 2</td>
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<td>Physical Education (two semesters) and swim test</td>
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<td>Required Major Courses&lt;sup&gt;b&lt;/sup&gt; (55 credits)</td>
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<td>Additional Engineering Requirements</td>
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<tr>
<td>Technical Writing Course</td>
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</table>

Total Required Credits 132 minimum

Notes

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

b. We recommend strongly that you obtain from 222 Phillips Hall or the ECE Undergraduate Handbook web site (www.ece.cornell.edu/ugradhndbk) an official ECE Graduation Check List appropriate for the Class of 2013 or later.
Major: Engineering Physics (EP)

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; and (3) the appropriate background for Ph.D. graduate work in science and/or engineering.

• Include throughout the undergraduate program hands-on experience in laboratory as well as design, computational, and research problems.

• Provide an environment characterized by the highest academic and ethical standards that instills pride in these standards and the program in general.

Introduction to Engineering Course
ENGRI 1XXX: Introduction to Engineering Course

Engineering Distributions (suggested)
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 4210–4220: 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 4410\textsuperscript{a}: Advanced Experimental Physics (Laboratory)
Engineering Physics Major (EP)

a. May simultaneously satisfy Major and distribution requirements.
b. EP offers two ENGRDs. ENGRD 2640 (recommended but not required; satisfies college technical writing requirement) offered in Fall and Spring, and ENGRD 2520, offered in the Spring.
c. May be taken in either semester 3 or 4. ECE 2100 and ECE 2300 can be substituted for AEP 3630.
d. 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).
### Engineering Physics 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>MATH 2930</td>
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<td>Introduction to Engineering: ENGRI 1XXX</td>
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<td>Engineering Distribution 1: ENGRD 2640 or 2520 (recommended)</td>
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<td>Engineering Distribution 2: AEP 3330 (recommended)</td>
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<td>Major-approved Elective</td>
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<tr>
<td>(Six Major-approved electives, five of which must be technical courses at or above the 3000 level) no S/U grades</td>
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<tr>
<td>Total Required Credits</td>
<td>128 minimum</td>
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<tr>
<td>Additional Elective Courses (0 credits minimum, no maximum)</td>
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<tr>
<td>Technical Writing Course&lt;sup&gt;c&lt;/sup&gt;: ENGRD 2640 (recommended)</td>
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</tbody>
</table>

Major: Engineering Physics
Notes

a. 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. (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 or ASTRO 4410 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. Nine credits of Major-complementary courses must be outside the Major.

e. Only three 4900 courses may be taken as Major-approved electives. They must be taken during the last four semesters.
Major: Environmental Engineering (EnvE)

Accredited by ABET (see inside front cover)
Offered jointly by:
Department of Biological and Environmental Engineering
207 Riley-Robb Hall, 607.255.2173, www.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 skills needed for successful professional careers. The educational program objectives are to:

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

Civil Engineering also offers a focus 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)\textsuperscript{a} or
ENGRI 1XXX: Introduction to Engineering

Engineering Distributions
BEE/ENGRD 2510: Engineering for a Sustainable Society (required)
ENGRD 2XXX\textsuperscript{m}: ENGRD 2020: Mechanics of Solids, ENGRD 2210: Thermodynamics, or ENGRD 3200: Engineering Computation are recommended.

Required Major Courses
BIOEE 1610: Ecology and the Environment or
BIOMG 1350: Principles of Cell and Development Biology or
BIOEE 1780: Evolutionary Biology and Diversity or
BLOG 1440: Intro to Comparative Physiology or
BLOG 1105: Introductory Biology\textsuperscript{b} or
BLOG 1106: Introductory Biology

ENGRD 2020: Mechanics of Solids\textsuperscript{b}
ENGRD 3200: Engineering Computation\textsuperscript{b} or
ENGRD 2210: Thermodynamics\textsuperscript{b}
CEE 3040: Uncertainty Analysis in Engineering\textsuperscript{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\textsuperscript{d}
Lab Course: CEE 4530: Laboratory Research in Environmental Engineering (fall), BEE 4270: Water Measurement and Analysis Methods (fall), or CEE 4370: Experimental Methods in Fluid Dynamics (every other spring) or CEE 6580 Biodegradation and Biocatalysis (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 or BEE 4890 are on the approved list)\textsuperscript{e}

Three Environmental design electives, 9 credit minimum (at least one from list of Capstone design courses and the remainder from a broader list of design courses)\textsuperscript{f}

Two Major-approved Engineering electives\textsuperscript{f}
Two approved electives
Environmental Engineering Major (EnvE)

a. BEE 1510 and BEE 1200 required of CALS matriculates; CS 111x and ENGRI required of COE matriculates.
b. ENGRD 2020, ENGRD 2210 or 3200, are required courses that may be used as a second distribution course.
c. ENGRD 2700 is 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 options.
d. The Intro Biology requirement can be satisfied by taking any one of the following: BIOE 1610, BIOMG 1350, BIOEE 1780, BIOG 1440, BIOG 1105, or BIOG 1106.
e. Students may choose from a list that is available in 207 Riley-Robb Hall or 221 Hollister Hall.
f. At least one design elective from list of Capstone design courses.
g. CALS matriculates must enroll in CHEM 2070 (fall); COE matriculates must enroll in CHEM 2090 (fall, spring).
### 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>
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<td>MATH 1920</td>
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<td>PHYS 1112</td>
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<td>PHYS 2213 (or 2217)</td>
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<td>BEE 1510, CS 1110, 1112, or 1114&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>CS 1130 or 1132&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>BLOG 1XXX&lt;sup&gt;c&lt;/sup&gt;</td>
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<td>First-Year Writing Seminar 1&lt;sup&gt;d&lt;/sup&gt;</td>
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<td>First-Year Writing Seminar 2&lt;sup&gt;d&lt;/sup&gt;</td>
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<td>Liberal Studies Distribution—six courses (18-credit minimum)</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 1</td>
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<tr>
<td>Physical Education (two semesters) and swim test</td>
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<td>Required Major Courses (57-credit minimum)</td>
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<tr>
<td>Introduction to Engineering (ENGRI 1XXX) or BEE 1200&lt;sup&gt;e&lt;/sup&gt;</td>
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<td>Engineering Distribution 1: BEE/ENGRD 2510 (required)</td>
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<td>Engineering Distribution 2: ENGRD XXXX&lt;sup&gt;f&lt;/sup&gt;</td>
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<td>ENGRD 2020&lt;sup&gt;g&lt;/sup&gt;</td>
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<td>Laboratory Course&lt;sup&gt;j&lt;/sup&gt;</td>
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<td>BEE 4750</td>
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<td>Design Elective 1 (Approved Capstone)&lt;sup&gt;k&lt;/sup&gt;</td>
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<td>Design Elective 3&lt;sup&gt;k&lt;/sup&gt;</td>
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<td>Major-approved Elective 1&lt;sup&gt;k&lt;/sup&gt;</td>
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<tr>
<td>Major-approved Elective 2&lt;sup&gt;k&lt;/sup&gt;</td>
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</tr>
<tr>
<td>Engineering electives to meet 57 credits</td>
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<tr>
<td><strong>Total Required Credits</strong></td>
<td>126 minimum</td>
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<tr>
<td><strong>Additional Elective Courses</strong> (0 credits minimum, no maximum)</td>
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<tr>
<td><strong>Technical Writing Course</strong>&lt;sup&gt;l,d&lt;/sup&gt;</td>
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</tr>
</tbody>
</table>

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<sup>a</sup> CHEM 2090 or CHEM 2070

<sup>b</sup> CS 1130 or 1132

<sup>c</sup> BLOG 1XXX

<sup>d</sup> First-Year Writing Seminar

<sup>e</sup> Introduction to Engineering (ENGRI 1XXX) or BEE 1200

<sup>f</sup> Engineering Distribution 1: BEE/ENGRD 2510 (required)

<sup>g</sup> ENGRD 2020

<sup>h</sup> CEE 3230 or BEE 4890

<sup>i</sup> CEE 4510

<sup>j</sup> Laboratory Course

<sup>k</sup> Design Elective 1 (Approved Capstone)

<sup>l</sup> Technical Writing Course
Notes

a. COE matriculates must enroll in CHEM 2090 (fall, spring); CALS matriculates must enroll in CHEM 2070 (fall).

b. Students matriculated in CALS may take BEE 1510 followed by CS 1130 for the computing requirement.

c. Choose one of the following: BIOEE 1610, BIOMG 1350, BIOEE 1780, BLOG 1440, BLOG 1105, or BLOG 1106.

d. In addition to the first-year writing seminars, a technical writing course must be taken. An approved COMM or ENGRC course, or BEE 4730, or BEE 4890, 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.

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

f. ENGRD 2020, 2210, or 3200 are recommended.

g. Students electing to use this course as a second engineering distribution must take an additional Major-approved elective.

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

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

j. CEE 4530 (fall), BEE 4270 (fall), CEE 4370 (every other spring), or CEE 6580 (spring).

k. 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 207 Riley-Robb Hall or 221 Hollister Hall.

l. If the course fulfilling the technical writing requirement also fulfills another requirement (e.g. liberal studies or Major-approved elective), then it may be used to satisfy both requirements.
Major: Information Science, Systems, and Technology (ISST)

Offered by:
Department of Information Science
303 Upson Hall, 255.9837, www.infosci.cornell.edu/ugrad and
School of Operations Research and Information Engineering (Management Science Option)
202 Rhodes Hall, 255.5088, www.infosci.cornell.edu/ugrad

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 it contains all the courses listed at www.infosci.cornell.edu/ugrad. In addition, students may choose to take INFO 4900: Independent Reading and Research, as one of their Major-approved elective courses, as discussed at www.infosci.cornell.edu/ugrad.
Engineering Distributions
ENGRD 2110: Object-Oriented Programming and Data Structures (required by the Major; recommended as a distribution course)
ENGRD 2700: Basic Engineering Probability and Statistics (required)

Required Major Courses
INFO 2040: Networks
ENGRC 3350: Communications for Engineering Managers
or
ILROB 1750: Behavior, Values, and Performance
or
INFO 2450: Communication and Technology
INFO 2300: Intermediate Design and Programming for the Web
INFO 3300: Data-Driven Web Applications
or
INFO 4300: Information Retrieval
or
INFO 4302: Web Information Systems
ORIE 3300: Optimization I
ORIE 3500: Engineering Probability and Statistics II
ORIE 3800: Information Systems and Analysis

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

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

For a complete listing of course options for Areas I-VI, visit www.infosci.cornell.edu/ugrad.
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. ENGRC 3350 fulfills the technical writing requirement.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Credit Hours</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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<td>MATH 2940</td>
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<tr>
<td>MATH 2930 or 3040 or CS 2800</td>
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<td>CHEM 2090 or 2150</td>
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<td>PHYS 1112 (or 1116)</td>
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<td>PHYS 2213 (or 2217)</td>
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<tr>
<td>PHYS 2214 (or 2218 or CHEM 2080 or 2160)</td>
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<td>CS 1110 (or 1112, or 1114) and CS 1130 (or 1132)</td>
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<td>Introduction to Engineering: (ENGRI 1XXX)</td>
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<td>Engineering Distribution 1: ENGRD 2700</td>
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<td>Engineering Distribution 2: CS 2110</td>
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<td>First-Year Writing Seminar 1</td>
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<td>Liberal Studies Distribution—six courses (18-credit minimum)</td>
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<td>Advisor Approved Elective (two courses; 6-credit minimum)</td>
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<td>Physical Education (two semesters) and swim test</td>
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<td>ORIE 3300</td>
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<td>ORIE 3500</td>
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<td>INFO 2300</td>
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<td>ORIE 3800</td>
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<tr>
<td>INFO 2450 or ILROB 1750 or ENGRC 3350</td>
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<td>Information Science/Management Science</td>
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<td>Option (nine course, 27-credit minimum)</td>
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<tr>
<td>Major-approved Elective</td>
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<tr>
<td>Major-approved Elective</td>
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</table>

Total Required Credits 127 minimum
Notes

a. 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.

b. CS 2110 is required by the Major, and it is recommended that this course be used as an engineering distribution course.

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

d. Nine credits of Major-complementary courses are required to be outside of the INFO rubric. These include one of INFO 2450, ILROB 1750, or ENGRC 3350; and two additional courses that are not INFO courses and are 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/).
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 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\textsuperscript{a}
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\textsuperscript{b}
MSE 4070: Materials Design Concepts II

\textbf{Electives}\textsuperscript{c}

Two materials-related electives covering two groups of different materials.\textsuperscript{c}

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.\textsuperscript{d}

One additional technical elective must be taken from outside MSE.\textsuperscript{e}
Materials Science and Engineering Major (MSE)
a. ENGRD 2610 or ENGRD 2620 satisfies the Major entry requirement.
## Materials Science and Engineering Major Check List

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
<th>Minimum Credit Hours</th>
<th>√ When Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1910</td>
<td></td>
<td>4</td>
<td></td>
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<tr>
<td>MATH 1920</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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<td>Technical Writing Requirementf</td>
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</table>
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 and online at www.mse.cornell.edu.

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

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

f. Nine credits of elective courses must be outside MSE. These are satisfied by the outside technical elective and by 6 credits of the Major materials application-related electives.
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)

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-approved 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 Major-approved courses and for advisor approved electives and technical elective guidelines, consult: mae.cornell.edu.
Mechanical Engineering Major (ME)

Note: Courses without prerequisites may be rearranged.
# Mechanical Engineering Major Check List

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<tr>
<th>Course</th>
<th>Credit Hours</th>
<th>When Done</th>
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<tr>
<td>MATH 1920</td>
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<tr>
<td>CHEM 2090 or 2150</td>
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<td>Introduction to Engineering: (ENGRI 1XXX)</td>
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<tr>
<td>First Year Writing Seminar 1e</td>
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<td>Liberal Studies 1</td>
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<td>M.E. Major Electives</td>
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Notes

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. Major-approved Electives 1 and 2 may be selected from any of the MAE courses in the following areas: aerospace engineering, biomechanics, energy and the environment, engineering materials, mechanical systems and design, thermo-fluids engineering, and vehicle engineering.

d. Introduction to Engineering (ENGRI 1XXX), ENGRD 2020, and ENGRD 2210, satisfy the Common Curriculum distribution requirement.

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).

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 (ORE)

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

Engineering Distributions
ENGRD 2110\textsuperscript{a}: 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\textsuperscript{b}
At least 6 credits of advisor approved electives
At least one of the courses taken must satisfy the technical writing requirement.
Operations Research and Engineering Major (ORE)

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. ORE 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 3040 (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.
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</table>
Notes

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. ORE affiliates are required to complete MATH 1910: Calculus for Engineers, MATH 1920: Multivariable Calculus for Engineers, and MATH 2940: Linear Algebra for Engineers (or their subject matter equivalents). 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 ORE. The following should be considered:

(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, thus students who do not take MATH 2930 must plan to take CHEM 2080.
(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. Students considering Ph.D.-level study in Operations Research are encouraged to see the Associate Director for advice regarding the fourth math course.

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

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

Introduction to Engineering Courses
ENGRI 1XXX: Introduction to Engineering Course

Common Curriculum
CHEM 2090: Engineering General Chemistry and then CHEM 2080: General Chemistry<sup>a</sup>
or
CHEM 2090: Engineering General Chemistry and CHEM 1570: Introduction to Organic and Biological Chemistry<sup>a</sup>

Engineering Distributions
ENGRD 2XXX
ENGRD 2XXX

Required Major Courses
EAS 2200: The Earth System
Two biology courses selected from the following:
BLOG/BIOEE 1610: Ecology and the Environment
BLOG/BIOEE 1780: Evolutionary Biology and Diversity
EAS/BIOEE 1540: Introductory Oceanography
or
EAS/BIOEE 1560: Introductory Oceanography with Laboratory
EAS 1700: Evolution of the Earth and Life

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):
Examples include:
EAS 2500: Meteorological Observations and Instruments
EAS 4170: Field Mapping in Argentina
EAS 4370: Geophysical Field Methods
EES Spring Semester in Hawaii, SEA Semester at Woods Hole, a course at Shoals Marine Laboratory, an internship, or a research project.

**Concentration Courses**

Four concentration courses are selected with the advisor’s approval, all within one of four defined areas of concentration. The areas of concentration include geological sciences (including geochemistry or geophysics), biogeochemistry, ocean sciences, or atmospheric sciences. Other areas of concentration within earth sciences are possible but must be approved by the SES Committee. The concentration 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 concentration courses count as Major-required courses and two of the concentration courses count as Major-approved electives.
Science of Earth Systems Major (SES)

a. Major requirement based on SES concentration.
b. If CHEM 2090–2080 is selected, CHEM 1570 can replace a second semester of biology.
c. Students must complete two biology courses selected from the following: BLOG/BIOEE 1610; BLOG/BIOEE 1780; EAS/BIOEE 1540 or EAS/BIOEE 1560; EAS 1700.
<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>MATH 1910</td>
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<tr>
<td>MATH 1920</td>
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<td>MATH 2930</td>
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<td>MATH 2940</td>
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<tr>
<td>CHEM 2090(^a) (or 2150)</td>
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<tr>
<td>CHEM 2080(^a) or 1570</td>
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<td>PHYS 1112</td>
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<td>PHYS 2213</td>
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<td>CS 1110 (or 1112, 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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<td>ENGRD 2XXX</td>
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<tr>
<td>First-Year Writing Seminar 1(^b)</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)</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>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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<tr>
<td>Required Major Courses (48-credit minimum)(^c)</td>
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<tr>
<td>EAS 2200</td>
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<td>Biology(^d)</td>
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<td>Biology(^a,d)</td>
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<td>EAS 3XXX core</td>
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<tr>
<td>Field Observation Course</td>
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<td>EAS Concentration (Major required)</td>
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<td>Major-approved elective (3XXX or higher)</td>
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<td>Outside Major Elective</td>
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**Total Required Credits**\(^c\) 123 minimum

**Technical Writing Course**\(^b\)
Notes

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. 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.

d. Students must complete two biology courses selected from the following: BLOG/BIOEE 1610; BLOG/BIOEE 1780; EAS/BIOEE 1540 or EAS/BIOEE 1560; EAS 1700. Students may petition their advisor and the Director of Undergraduate Studies to replace one course in biology with an additional course in chemistry, physics, or math.
Minors

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

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

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

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

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.

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)

Business (AEM) offered by the College of Agriculture and Life Sciences

Civil Infrastructure (CEE)

Computer Science (CS)
Minor: Aerospace Engineering

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

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

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

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

2. Rules for ME Majors:
   (a) Select at least four courses from group A, of which you must choose MAE 3050 or
MAE 3060 (or both).

(b) Select at most two courses from group B. No courses from group C may be used.

(c) Two courses must be selected from the Aerospace Engineering subject field from Mechanical Engineering Major Approved Electives in Mechanical Engineering (for a complete listing, consult www.mae.cornell.edu). These two courses may not be used towards fulfilling the B.S., Mechanical Engineering degree requirements.

3. Rules for other Majors:

(a) Select at least four courses from group A, of which you must choose MAE 3050 or MAE 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\*: Supervised Senior Design Experience (with Aerospace focus)
or MAE 4900\*: Individual and Group Projects in Mechanical 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: Mechanical Properties and Selection of Engineering Materials
MAE 3240: Introductory Fluid Mechanics
MAE 3240: Heat Transfer
Minor: Applied Mathematics
Offered jointly by: Sibley School of Mechanical and Aerospace Engineering and the Department of Mathematics

Students intending to earn a minor in Applied Mathematics should seek advice and pre-approval of their minor academic program from Professor Richard Rand, RHR2@cornell.edu.

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

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

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

(a) At most one course may be chosen from 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 3230: Introduction to Differential Equations
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 Inference for Random Signals and Systems
ENGRD 2700: Basic Engineering Probability and Statistics
MATH 4710: Basic Probability
ORIE 3500: Engineering Probability and Statistics II

**Group 4. Applications**
AEP 3330: Mechanics of Particles and Solid Bodies
CEE 3310: Fluid Mechanics
CEE 3710: Structural Modeling and Behavior
CHEM 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

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

Also:
TAM 5700: Intermediate Dynamics

You may also 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

**Group 6. Mathematics Courses**

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

(i) MATH 3230 or MATH 4200, if any course from group 1 is chosen.
(ii) MATH 4710, if any course from group 3 is chosen.
(iii) MATH 4220, if AEP 3220 is chosen from group 5.
(iv) Only one of the following may be chosen:
    - MATH 3320: Introduction to Number Theory
    - MATH 3360: Applicable Algebra

**Academic Standards**

At least C in each course in the minor.

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**Minor: Biological Engineering**

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

**Eligibility**

All undergraduates except Biological Engineering Majors.

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. This minor is an opportunity for students to further their understanding of living systems and to increase their knowledge of the basic transport processes that occur within these systems.
Courses in the minor provide opportunities to analyze, design, and manipulate living systems at the molecular, cellular, and system levels.

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

**I. Biology Foundation** (at least one but no more than two courses)
- BIOMG 3300 or 3310–3320: Principles of Biochemistry
- 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 4590: Biosensors and Bioanalytical Techniques
- BME 3300: Introduction to Computational Neuroscience
- BME 5020: Biomedical System Design
- BME 5390: Biomedical Materials and Devices for Human Body Repair
- BME 5650: Biomechanical Systems—Analysis and Design
- CHEME 4810: Biomedical Engineering
- ECE 5780: Computer Analysis of Biomed Images
- MAE 4630: Neuromuscular Biomechanics
- MAE 4640: Orthopaedic Tissue Mechanics
- 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)
CHEME 3320: Analysis of Separation Processes
CHEME 5430: Biomolecular Engineering of Bioprocesses

Bioenvironmental Engineering Concentration
BEE 3710: Physical Hydrology for Ecosystems
BEE 4010: Renewable Energy Systems
BEE 4350: Principles of Aquaculture
BEE 4710: Introduction to Groundwater
BEE 4730: Watershed Engineering
BEE 4870: Sustainable Bioenergy Systems
CEE 4510: Microbiology for Environmental Engineering
CEE 4520: Water Supply Engineering

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

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**Minor: Biomedical Engineering**

Offered by: Department of Biomedical Engineering
Contact: Belinda Floyd, Graduate Field Assistant, 109 Weill Hall, minor_bme-mailbox@cornell.edu, 255.2573

**Eligibility**
All undergraduates are eligible. 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 listing from Category 1.

• Four courses must come from Category 3 (Molecular and Cellular Biomedical Engineering); Category 4 (Biomedical Engineering Analysis of Physiological Systems); and Category 5 (Biomedical Engineering Applications), with courses from at least two of these categories represented.

• At least four of the six courses must not be specifically required Major degree courses or cross-listings. A course chosen from a list of major electives is acceptable.

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

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

A score of 5 on (CEEB) Advanced Placement Biology
ENGRI 1310: Introduction to Biomedical Engineering
BIOG/BIOMG 1350: Principles of Cell and Developmental Biology
BIOG/BIOMG 1440: Introduction to Comparative Biology
BIOG 1105 and 1106: Introductory Biology
BIOG 1107 and 1108: General Biology
BIOG 1140: Foundations of Biology

Pre-med introductory biology requirements as outlined by the Health Careers Program Advisory Board of Cornell University.

Category 2. Advanced Biology

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

Category 3. Molecular and Cellular Biomedical Engineering

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

Category 4. Biomedical Engineering Analysis of Physiological Systems
BIONB/BME/COGST/PSYCH 3300: Introduction to Computational Neuroscience
BIONB/BME 4910: Principles of Neurophysiology
BME 4010/MAE 4660a: Biomedical Engineering Analysis of Metabolic and Structural Systems
BME 4020a: 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
BME 5400: Biomedical Computation
BME 5600: Biotransport and Drug Delivery
BME 5810/MAE 5680: Soft Tissue Biomechanics
BME 5830: Cell-Biomaterials Interactions
CS/BIOMG/ENGRD 3510: Numerical Methods in Computational Molecular Biology
DEA/BME 4520: Inside-Out Ergonomics II
ECE/BME 4980: Special Topic: Introduction to Systems and Synthetic Biology
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 C– in each course in the minor. GPA $\geq$ 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: Business for Engineering Students

Offered by: College of Agriculture and Life Sciences
Contact: AEM Undergraduate Program, 146 Warren Hall

Eligibility

All Engineering undergraduates, except those majoring in Operations Research and Engineering, are eligible to apply beginning the first semester of their second year. Students planning to major in Chemical Engineering should meet with a member of the Engineering Advising staff during their first or second year to discuss requirements and possible courses of study to complete the minor. Acceptance into the minor is selective. An application form is available to students on the Engineering college web site, and in 167 Olin Hall and 146 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)
or
MATH 1710: Statistical Theory and Application in the Real World

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

AEM 1200: Introduction to Business Management

AEM 2400: Marketing

AEM 3240: Finance
or
AEM 2240: Principles of Finance
Academic Standards
At least C– in all courses counting toward the minor.

Notes
The College of Engineering does not award AP credit for statistics, but AP statistics credit is awarded if it is used to fulfill AEM’s requirement for the Business 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. This course 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 3240: Finance will still be required for the AEM Major.

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

Eligibility
All undergraduates except Civil Engineering Majors.

Educational Objectives
The Civil Infrastructure minor is intended to introduce engineering undergraduates to the engineering methodologies of mechanics, materials, analysis, design, and construction and to show how these are brought to bear in solving problems in the development, maintenance, and operation of the built environment that is vital for any modern 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: Introduction to the Behavior of Metal Structures
CEE 4780: Structural Dynamics and Earthquake Engineering

Other Related Courses
CEE 5950: Construction Planning and Operations

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

Note
a. Other CEE courses approved by petition in advance.

Minor: Computer Science
Offered by: Department of Computer Science
Contact: Nicole Roy, 303 Upson Hall, 255.0982, nicole@cs.cornell.edu

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

Educational Objectives
This minor is for students who anticipate that computer science will have a prominent role to play in their academic and professional career.

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 3410: Computer System Organization and Programming
or
CS 3420/ECE 3140: Computer Organization

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

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

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

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

**Eligibility**
All undergraduates except Electrical and Computer Engineering Majors.

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

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

**Two (2) of the following:**
- ENGRD/ECE 2100: Introduction to Circuits for Electrical and Computer Engineers
- ECE 2200: Signals and Information
- ENGRD/ECE 2300: Introduction to Digital Logic Design

**Two (2) of the following**
- ECE 3030: Electromagnetic Fields and Waves
- ENGRD/ECE 3100: Introduction to Probability and Random Signals
- ECE 3140/CS 3420: 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**
At least C– for every course in the minor and a GPA $\geq 2.3$ for all courses in the minor.

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**Minor: Engineering Management**

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

**Eligibility**
All undergraduates. (CE Majors may not use courses to fulfill the minor requirement and
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\(\text{a}\): Financial and Managerial Accounting
CEE 3040\(\text{b}\): 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)\(\text{c}\)
CEE 4060: Civil Infrastructure Systems
CEE 4920: Engineers for a Sustainable World: Engineering in International Development
CEE 5930\(\text{d}\): Engineering Management Methods:
CEE 5950: Construction Planning and Operations
CEE 5970: Risk Analysis and Management
NBA 5070: Entrepreneurship for Scientists and Engineers
or
MAE 4610/ENGRG 4610/ORIE 4152: Entrepreneurship for Engineers
or
BEE 4890: Entrepreneurial Management for Engineers

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

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

b. TAM 3100: Introduction to Applied Mathematics I cannot be substituted for CEE 3040.

c. Other courses approved by petition in advance.
**Minor: Engineering Statistics**

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

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

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

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

**Required Courses**  
ENGRD 2700: Basic Engineering Probability and Statistics  
ORIE 3500: Engineering Probability and Statistics II  
or  
ECE 3100: Introduction to Probability and Random Signals

**Four courses** (11 credits minimum) taken from the following list

- ORIE 3510: Introductory Engineering Stochastic Processes I  
or  
- ECE 4110: Random Signals in Communications and Signal Processing  
- ORIE 4580: Simulation Modeling and Analysis  
- ORIE 4710: Applied Linear Statistical Models  
- ORIE 4711: Experimental Design  
- ORIE 4712: Regression  
- ORIE 5550: Applied Time-Series Analysis  
- ORIE 5770: Quality Control  
- MATH 4720: Statistics or BTRY 4090: Theory of Statistics  
- BTRY 6020: Statistical Methods II  
- BTRY 6030: Statistical Methods III  
or  
- ILRST 4110: Statistical Analysis of Qualitative Data  
or  
- ILRST 3100: Statistical Sampling  
- ILRST 4100: Techniques of Multivariate Analysis
Academic Standards
At least C– in each course in the minor and a GPA ≥2.0 in all courses in the minor.

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

Minor: 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
All undergraduates except Environmental Engineering Majors.

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 4440: Environmental Site and Remediation Engineering
CEE 4510: Microbiology for Environmental Engineering
CEE 4530: Laboratory Research in Environmental Engineering
CEE 4540: Sustainable Municipal Drinking Water Treatment
CEE 4550: AguaClara: Sustainable Water Supply Project
BEE 4760: Solid Waste Engineering
BEE/EAS 4800: Our Changing Atmosphere: Global Change and Atmospheric Chemistry
BEE 4870: Sustainable Bioenergy Systems
CEE 4920: Engineers for a Sustainable World: Engineering in International Development
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: Sustainable Design for Appledore Island (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
CEE 4650/6650: Transportation, Energy, and Environmental Systems for Sustainable Development

**Group C. Hydraulics, Hydrology, and Environmental Fluid Mechanics**
CEE 3310: Fluid Mechanics (CHEME 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/EAS 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 6720: Drainage

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

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**Minor: Game Design**
Offered by: Department of Computer Science
Contact: Nicole Roy, 303 Upson Hall, 255.0982, nicole@cs.cornell.edu

**Eligibility**
All undergraduates. CS Majors may not count courses from the CS-focused list toward completion of 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 Computer Game Design

Additional Courses: Choose four of the following 12 courses:

CS-Focused courses:
CS/ENGRD 2110: Object-Oriented Programming and Data Structures
CS/INFO 3300: Data-Driven Web Applications
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:
ART 1701: Introduction to Digital Media
ART 2704: Interactive Digital Media
COMM 4220: Psychology of Entertainment Media
ECE 4760: Digital Systems Design Using Microcontrollers
INFO/COMM 3450: Human–Computer Interaction Design
INFO/COMM 4400: Advanced Human–Computer Interaction Design
MUSIC 2421: Computers in Music Performance
MUSIC 3421: Scoring the Moving Image
SOC 4340: Online Social and Information Networks
**Academic Standards**
At least C for each course in the minor.

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

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

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

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

**Required courses:**
- ENGRD 2700: Basic Engineering Probability and Statistics
- ORIE 3120: Industrial Data and Systems Analysis
- ORIE 4800: Information Technology

**The remaining courses/credit hours from the following:**
- ORIE 3150: Financial and Managerial Accounting
- ORIE 3300: Optimization I
- ORIE 4150: Economic Analysis of Engineering Systems
- ORIE 4580: Simulation Modeling and Analysis
- ORIE 4810: Delivering OR Solutions with Information Technology
- ORIE 4850: Applications of Operations Research and Game Theory to Information Technology
- ORIE 5100: Design of Manufacturing Systems
- ORIE 5120: Production Planning and Scheduling Theory and Practice
- ORIE 5770: Quality Control

**Academic Standards**
At least C– in each course in the minor and a GPA $\geq 2.0$ in all courses in the minor.
**Minor: Information Science**

Offered by: Department of Computer Science  
Contact: Christine Stenglein, 303 Upson Hall, 255.9837, minor@infosci.cornell.edu

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

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

**Requirements**  
At least six (6) courses (minimum of 18 credits) chosen as follows:  
Statistics: one course, either CEE 3040 or ENGRD 2700  
Information Systems: two courses  
Human-Centered Systems: one course  
Social Systems: one course  
Elective: one additional course from either Human-Centered Systems or Social Systems

**Academic Standards**  
At least C in each course in the minor. All courses for the minor must be taken at Cornell. For a complete listing of course options and restrictions, visit www.infosci.cornell.edu/ugrad/concentrations.html.

**Minor: Materials Science and Engineering**

Offered by: Department of Materials Science and Engineering  
Contact: MSE Undergraduate Program Director, 214 Bard Hall, 255.9159

**Eligibility**  
All undergraduates except those majoring in Materials Science and Engineering.

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

**Requirements**  
At least six (6) courses (≥18 credits), chosen as follows:
Required
MSE 2610: Mechanical Properties of Materials: From Nanodevices to Superstructures
or
MSE 2620: Electronic Materials for the Information Age

Two of the following:
MSE 2060: Atomic and Molecular Structure of Matter
MSE 3010: Materials Chemistry
MSE 3030: Thermodynamics of Condensed Systems
MSE 3040: Kinetics, Diffusion, and Phase Transformation
MSE 3050: Electronic, Magnetic, and Dielectric Properties of Materials
MSE 4020: Mechanical Properties of Materials, Processing, and Design

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

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

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

Eligibility
All undergraduates except those majoring in Mechanical Engineering.

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

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

**Requirements**
At least six (6) courses (≥18 credits) from among the following: MAE courses at the 2000+ level; ENGRD 2020: Mechanics of Solids; and 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 C– in each course in the minor

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**Minor: Operations Research and Management Science**

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

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

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

**Requirements**
At least six (6) courses (≥18 credits), chosen as follows:
Choose three courses from the following list:
ENGRD 2700: Basic Engineering Probability and Statistics
ORIE 3300: Optimization I
ORIE 3310: Optimization II
ORIE 3500: Engineering Probability and Statistics II
ORIE 3510: Introduction Engineering Stochastic Processes I
ORIE 4580: Simulation Modeling and Analysis

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

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

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

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

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

Requirements
There are two options for satisfying the minor requirements:

Option 1:
At least six (6) courses (≥18 credits), chosen as follows:

1. Required introductory course:
   EAS 2200: The Earth System

2. 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

3. 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.

**Option 2:**
At least six (6) courses (≥18 credits), chosen as follows:

1. Required introductory course:
   EAS 2200: The Earth System
2. The Earth and Environmental Systems Semester in Hawaii Program
3. One additional EAS course at the 3000 level or higher.

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

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**Minor: Sustainable Energy Systems**
Offered collaboratively by: Biological and Environmental Engineering, Chemical and Biomolecular Engineering, Earth and Atmospheric Sciences, and Mechanical and Aerospace Engineering. Administered by the Department of Chemical and Biomolecular Engineering.

Contacts: Curricular topics: Jeff Tester, Director, Cornell Energy Institute, jwt45@cornell.edu; Administrative or registrar topics: Carol Casler, undergraduate programs office of the School of Chemical and Biomolecular Engineering, 607-255-8656

**Eligibility**
All undergraduates at Cornell.

**Educational Objectives**
Providing affordable energy to meet the demands of both developed and developing nations without further damaging the natural environment and the Earth’s climate system is a Grand Challenge for the 21st century. Our quality of life and the stability of nations ultimately depend on having accessible energy resources and an equitable and sustainable energy supply and distribution system. Achievement of these goals requires the participation, ingenuity, and hard work of people with a range of specialized backgrounds, working collaboratively. The minor is intended to emphasize the importance of viewing the challenge of meeting the world’s energy needs as a system of interacting themes. The requirements of the minor are designed to provide breadth across a range of energy resource types and conversion, transmission and storage technologies along with coverage of the environmental, economic, political, and social consequences of various options.

**Requirements**
- Six courses and a minimum of 18 credits; at least 3 credits in each category
- At least two courses in category 2: Energy Sources and Technologies for a Transition to Sustainability
- At least one course from each of four breadth categories
Four Breadth Categories

(1) Energy Systems Analysis
(2) Energy Sources and Technologies for a Transition to Sustainability
(3) Natural Systems Impacted by Energy Production and Use
(4) Social Impact: Policy, Economics, Business, History, Ethics, and Risk Analysis

• At most two courses may be specific requirements in the student’s Major

Courses satisfying each of the breadth categories:

(1) Energy Systems Analysis

BEE 4010: Renewable Energy Systems
BEE 4870: Sustainable Bioenergy Systems
CHEME 6660: Analysis of Sustainable Energy Systems
MAE 5010: Future Energy Systems

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

(a) Fossil and Nuclear Energy

CHEME 5204/5207: Turbomachinery Applications/Hydrocarbon Resources and Petroleum Refining (series of two 1-2 credit hour courses)
EAS 4010: Fundamentals of Earth and Minerals Resources
EAS 4340: Exploration Geophysics
EAS 4370: Geophysical Field Methods
MAE 4590: Nuclear Fusion (also NSE 4840)
MAE 4590/NSE/AEP/NSE 4840: Introduction to Controlled Fusion: Principles and Technology
TAM/AEP/CHEME/ECE/MAE/NSE 4130: Introduction to Nuclear Science and Engineering

(b) Renewable Energy

BEE 4900: Biofuels: The Economic and Environmental Interactions
MAE 4020: Wind Power

(c) Energy Conversion, Distribution, and Storage

ECE 4510: Electric Power Systems I
ECE 4520: Electric Power Systems II
MAE 5430: Combustion Processes
MAE 4490: Combustion Engines and Fuel Cells
MSE 4330: Materials for Energy Production, Storage and Conversion
ORIE 5142: Systems Analysis Architecture, Behavior and Optimization
ORIE/CEE 5140/CIS 5040, ECE 5120, MAE 5910 5140: Applied System Engineering
(3) Natural Systems Impacted by Energy Production and Use

BEE 3710: Physical Hydrology for Ecosystems
BEE 4800: Our Changing Atmosphere: Global Geophysics and Atmospheric Chemistry
BEE 6740: Ecohydrology
BIOEE/EAS 3500: Dynamics of Marine Ecosystems
BIOEE/NTRES 4560: Stream Ecology
CEE 4320: Hydrology
CHHEME 6610: Air Pollution Control
EAS/NTRES 3030: Introduction to Biogeochemistry
EAS 4400: Seminar: Climate Science, Impacts, and Mitigation
EAS 3050: Climate Dynamics
EAS 3530: Physical Oceanography
EAS 4570: Atmospheric Air Pollution
Laboratory and NTRES 4220: Wetland Ecology Lecture
MAE/EAS 6480 Air Quality and Atmospheric Chemistry
NTRES 4201: Forest Ecology Laboratory and NTRES 4200: Forest Ecology

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

AEM 4510/ECON 4090: Environmental Economics
BSOC/STS 2061/PHIL 2460: Ethics and the Environment
BSOC/STS 3181: Living in an Uncertain World: Science, Technology and Risk
CEE/TOX 5970: Risk Analysis and Management
CHHEME 6640: Energy Economics
DSOC 3240/STS 3241/SOC 3240: Environment and Society
ENGRG/ECE/HIST 2500/STS 2501: Technology in Society
ENGRG/ECE 3600/STS 3601: Ethical Issues
MAE/STS 4000: Components and Systems: Engineering in a Social Context
NTRES 3320: Introduction to Ethics and the Environment
ORIE 4150: Economic Analysis of Engineering Systems

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

**Academic Standards**

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

Dual-Degree Option
The dual-degree program is intended for superior students. Students can earn both a Bachelor of Science and either a Bachelor of Arts or a Bachelor of Fine Arts degree in about five years (ten semesters). After acceptance of their application, engineering students begin the dual-degree program in their second or third year. For more information about this option, students can attend a Dual Degree Information Meeting, held approximately once a month (www.arts.cornell.edu/programs/dualdeg.php), or contact Engineering Advising, 167 Olin Hall.

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

Double Majors
The double Major makes it possible to study two allied engineering disciplines. A double Major generally requires nine semesters. (Students dependent on financial aid who spend more than eight semesters as an undergraduate will need to change their financial-aid package.)

To embark on a double Major, a student must complete the entry requirements for both Majors and have a cumulative GPA $\geq 3.0$ after the first four semesters. Affiliation with the first Major proceeds as usual. Before the end of the third year, the student presents an application for Double Major to enter the second Major. The application must be approved by the faculty in both Majors. The second Major may set its own requirements, and admission is not guaranteed. Obtain application forms from Engineering Advising and submit completed forms to the Engineering Registrar, 158 Olin Hall.

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

The standards for academic performance of both Majors must be met, although the consequences for failing to do so for one or the other will differ. For example, deficient performance in the primary area may result in a required leave of absence or withdrawal from the Major (resulting perhaps in withdrawal from the college), but deficient performance in the secondary Major simply terminates the double Major. For more information, contact Engineering Advising, 167 Olin Hall, and the individual Major consultant offices.

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

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

Students should apply by the end of 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, contact Engineering Advising, 167 Olin Hall.

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

International Engineering Programs

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

Because most engineering curricula are highly structured with many sequential courses, students who wish to pursue this option must decide early and plan carefully. Advisors and faculty in the college can suggest a variety of ways for students to study abroad and still meet graduation requirements. Students interested in studying or working abroad should begin gathering information early in the first year. 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.

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 (ECP)

The ECP provides instruction in technical writing, oral presentation, and the use of graphics in both. 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.

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

For more information, call 255.8558, visit the ECP’s office at 465 Hollister Hall, visit any ECP staff member on the fourth floor of Hollister Hall, or visit www.engineering.cornell.edu/programs/undergraduate-education/engineering-communications/.
**Engineering Cooperative Education Program (Co-op)**

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

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

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

Obtain more information at www.engineering.cornell.edu/coop or at the 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 fields. Research gives students the opportunity to interact closely with faculty mentors and, in many instances, to develop valuable industry connections. Engineering students and faculty members may apply for funding awards to support undergraduate research projects for the fall, spring, and summer terms. Funds may be used to provide a student stipend or to cover project expenses. 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/.

**Cooperative Programs with The Johnson School**

For information about program options at The Johnson School, stop by the admissions office in 111 Sage Hall or visit the website www.johnson.cornell.edu/prospectivestudents/.
Course Registration

Registration

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

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

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

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

The Course Add/Drop Form

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

The add/drop form requires the following information:

- Student Identification Number, semester, and year of study, and full name.

- The four to five-digit course identification number (CID), the department/course name, and the number of credit hours for the course a student wishes to change. (This information can be found via the Student Center or in the Course and Time Roster, which is also available online.)

- Approval from the department offering the course. Because each department keeps a running tally of the numbers of students enrolled in each lecture, section, or laboratory, students must receive departmental approval before making formal changes to their schedule. (The location of departmental offices can be found in the campus directory or Courses of Study.)

- The student’s signature and the date.

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

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

Dropping a Course
Students may drop a course 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.

Dropping a course during weeks 8 to 12 requires a petition (available in the Engineering Registrar’s office, 158 Olin Hall) in addition to the add/drop form. The petition must be signed by the student’s academic advisor. Submit the completed petition and add/drop form to Engineering Advising, 167 Olin Hall.

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

No course may be dropped after the twelfth week of classes, even with a petition.

Changing a Grade Option
During weeks one to three of the semester, change a grade option (on courses where a choice between letter or S/U grade is offered) using the online add/drop system, or with an add/drop form for “permission only” courses. If an add/drop form is used, permission of the faculty advisor and course instructor or departmental representative must be obtained. Submit the completed add/drop form to the Engineering Registrar’s office, 158 Olin Hall, by the end of the third week of classes.

Important: After 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 when they enroll, in consultation with the instructor and their faculty advisor. (For example, a course listed as “variable to 5 credits” can be taken for 1, 2, 3, 4, or 5 credits.)

During weeks one to three of the semester, change credit hours (on courses that offer variable credit) using the online add/drop system, or with an add/drop form for “permission only” courses. If an add/drop form is used, permission of the faculty advisor and course instructor or departmental representative must be obtained. Submit the completed add/drop form to the Engineering Registrar’s office, 158 Olin Hall, by the end of the third week of classes.
After the third week of classes, variable credit hours may not be changed except by petition (see previous section on “adding a course after week three” for instructions).

Course Pre-Enrollment through CoursEnroll

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

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

To request courses through CoursEnroll:

• Determine your pre-enrollment access period by reading The Sundial, by contacting the Engineering Registrar’s office, 158 Olin Hall, or by checking your Student Center account.

• Check the online Course and Time Roster or view classes via the Student Center.

• Decide which courses you want to take the next semester, keeping in mind the requirements for the Common Curriculum and your intended Major program.

• Meet with your faculty advisor prior to the pre-enrollment period to discuss the proposed course schedule and make changes as necessary.

• Use CoursEnroll to enter your course choices.

This completes the pre-enrollment process.

Maximum Number of Credits per Semester

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

ROTC Courses

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

1. Up to 6 credits of ROTC courses numbered ≥ 3000 may be used as advisor-approved electives;

2. ROTC courses that are co-listed by another department (e.g. 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. Check with the undergraduate coordinator office to find out whether such courses will count toward graduation.
Grades and Credit

Grades

The grading system used at the university is shown below.

<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>Good: moderately broad knowledge and understanding of subject matter; noticeable perception and/or originality</td>
</tr>
<tr>
<td>A–</td>
<td>3.7</td>
<td>Average: reasonable knowledge and understanding of subject matter; moderate perception and/or originality</td>
</tr>
<tr>
<td>B+</td>
<td>3.3</td>
<td>Fair: minimum knowledge and understanding of subject matter; some perception and/or originality</td>
</tr>
<tr>
<td>B</td>
<td>3.0</td>
<td>Satisfactory: reasonable knowledge and understanding of subject matter; some perception and/or originality</td>
</tr>
<tr>
<td>B–</td>
<td>2.7</td>
<td>Poor: minimum knowledge and understanding of subject matter; limited perception and/or originality</td>
</tr>
<tr>
<td>C+</td>
<td>2.3</td>
<td>Marginal: minimum knowledge and understanding of subject matter; limited perception and/or originality</td>
</tr>
<tr>
<td>C</td>
<td>2.0</td>
<td>Unsatisfactory: insufficient knowledge and understanding of subject matter; severely limited perception and/or originality</td>
</tr>
<tr>
<td>C–</td>
<td>1.7</td>
<td>Fail: unacceptably low knowledge and understanding of subject matter; severely limited perception and/or originality</td>
</tr>
<tr>
<td>D+</td>
<td>1.3</td>
<td>Unsatisfactory: insufficient knowledge and understanding of subject matter; severely limited perception and/or originality</td>
</tr>
<tr>
<td>D</td>
<td>1.0</td>
<td>Fail: unacceptably low knowledge and understanding of subject matter; severely limited perception and/or originality</td>
</tr>
<tr>
<td>D–</td>
<td>0.7</td>
<td>Fail: unacceptably low knowledge and understanding of subject matter; severely limited perception and/or originality</td>
</tr>
<tr>
<td>F</td>
<td>0.0</td>
<td>Fail: unacceptably low knowledge and understanding of subject matter; severely limited perception and/or originality</td>
</tr>
</tbody>
</table>

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–; U is equivalent to a grade of D+ or less.)

Important: After 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 is offered with an S/U option.
The student has completed at least one full semester of study at Cornell. First-year students may not take any courses on an S/U basis during their first semester except for courses that are graded “S/U Only”.

The S/U course must be used as either a liberal-studies distribution or an approved elective in the Engineering curriculum.

Students may 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 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. In such situations, it is desirable to receive a temporary grade of incomplete and finish the course work at a later time.

To receive an incomplete, students must:

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

Incomplete grades are granted at the discretion of the course instructor. If you think an incomplete is appropriate, 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 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. It may be helpful to discuss the matter with a faculty advisor or a staff member in Engineering Advising.

Advanced Placement and Transfer Credit
Many students come to Cornell with advanced placement credit for courses taken in high school or with courses taken at an accredited college that are similar to courses offered here. Students who think they are already competent in the subject matter of a course offered at the introductory level can demonstrate their proficiency and receive credit for the course without actually taking it.

There is a difference between advanced placement credit and transfer credit. Advanced placement credit is awarded when a student shows competence in a subject by doing well on an approved exam. Transfer credit is awarded for a course that has been satisfactorily completed at another college and that has not been used to meet high school graduation requirements.
The only courses for which students may obtain advanced placement or transfer credit are those that fit degree requirements in the undergraduate engineering program. The College of Engineering decides whether credit should be awarded for particular courses, and in all cases this decision is final.

Advanced Placement Credit

Students may become eligible for advanced placement credit in four ways:

• By taking a College Entrance Examination Board (CEEB) examination,
• By successfully completing a General Certificate of Education (GCE) Advanced (A-Level) examination,
• By successfully completing an International Baccalaureate (IB) Higher Level examination, or
• By taking a 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 credit need not be accepted. Choosing to accept credit will depend, in part, on whether a course is a technical course that will be a prerequisite for other courses in a student’s academic program. If it is not a technical prerequisite, there is no reason not to accept it. If it is a technical prerequisite, students should make certain that they are really prepared to take the next course in the sequence.

Departmental examinations test technical preparedness, and in this sense, they are better than CEEB AP exams, which may not test for what Cornell expects a student to know. The departmental exam is designed to test the depth of knowledge in the entire range of material customarily covered in a particular course offered at Cornell. Satisfactory performance on such an exam indicates that students already know what they would have learned if they had taken the Cornell course. Satisfactory performance on the CEEB AP exam is not as good an indication that a student knows the entire range of material. When in doubt, students should feel free to take a departmental exam, even if they have already passed the CEEB AP exam.

Since the amount of advanced placement or transfer credit awarded can affect the degree of difficulty of the first year and subsequent success as an engineering student, students should consider the options carefully, seeking advice from their faculty advisors during Orientation Week and talking with the undergraduate coordinator (see pages 10–11) for the primary Major of interest. The first year at Cornell is crucial to the development of an undergraduate program; wise use of advanced placement and transfer credit can make a positive difference.

Acceptable Subjects and Scores

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

Students can earn advanced placement credit for competence in a foreign language by taking the CEEB AP test or by taking the Cornell Advanced Standing Examination (CASE). Those with a score of 4 or 5 on the CEEB AP test in French, German, Italian, or Spanish will be awarded 3 credits. Qualification for the CASE (in any language) requires at least a 65 on a college placement test (taken either in high school or at Cornell during Orientation 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 faculty advisor.

Other Subjects

Advanced placement credit is granted for many subjects not discussed here. If guidelines for a subject area are not spelled out below, the College of Engineering follows the AP guidelines found in the “General Information” section of Courses of Study or online at http://cuinfo.cornell.edu/Academic/Courses/FM.php.

General Policies for Advanced Placement Credit

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

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

2. All advanced placement examinations are normally taken and scored before fall-term classes begin. Students who take CEEB AP tests in high school should have an official report of their scores sent directly to Cornell as soon as possible. Students who have completed either GCE A-level or IB Higher Level examinations must present the original or a certified copy of their examination certificate to Engineering Advising, 167 Olin Hall. Those who wish to take departmental examinations must do so during Orientation Week.
Advanced Placement Credit Table

<table>
<thead>
<tr>
<th>Requirements</th>
<th>CEEB AP 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 Cornell Departmental Exam</td>
<td>A, B, or C on Math or Pure Math exams (1910 only)</td>
<td>No credit⁺</td>
</tr>
<tr>
<td>1910 required</td>
<td></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></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2213 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>2090ᵇ</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></td>
<td>6 or 7</td>
</tr>
<tr>
<td>CS 1110, 1112, 1113, or 1114</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biology</td>
<td>4</td>
<td>A or B</td>
<td>6</td>
</tr>
<tr>
<td>4 credits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 credits</td>
<td>5</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>8 credits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First-Year Writing Seminar (two required)</td>
<td>5 (English)ᶜ</td>
<td></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 visit: http://www.admissions.cornell.edu/downloads/adv_placement_intl_credentials.pdf

Notes

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

b. Students who obtain advanced placement credit for CHEM 2090 and are thinking of majoring in ChemE or MSE should consider enrolling in CHEM 2150. Those who are offered credit for CHEM 2090 and then elect to take CHEM 2150 will also receive academic credit for CHEM 2090. You may want to discuss this option with your faculty advisor.

c. Students receiving a 4 on the CEEB AP English Literature and Composition exam or the CEEB AP English Language and Composition exam, a 6 on the IB Higher Level English exam, or a B on the GCE A-level English exam will be eligible for 3 credits, which may be applied toward the Literature and the Arts category in the Liberal Studies Distribution requirement.
Transfer Credit

General Policies for Transfer Credit

• Only courses that meet degree requirements for the undergraduate engineering program and are deemed equivalent in scope and rigor to courses offered at Cornell will be considered for transfer credit.

• A grade of at least C (not C-) must have been earned in the course being transferred; schools and departments may stipulate a higher minimum grade.

• At most, 18 transfer or Cornell extramural study credits may be applied to engineering degree requirements after a student matriculates at Cornell. (Credit for summer session courses taken at Cornell is not considered transfer credit.)

• Transfer credit will not be awarded for courses taken during a semester in which a student is enrolled at Cornell.

• Transfer credit will not be awarded for cooperative courses taken while in high school, technical skills, or general knowledge acquired through personal experience, employment, or military training.

• Transfer credit will only be awarded if/when the student has submitted a detailed course syllabus or outline, and a certified copy of the student’s official transcript from the host institution (photocopies are not acceptable). Current students must also submit a completed Transfer Credit Form. Incoming First-Year students submit a completed High School Credit Form.

• Credit in excess of that awarded by Cornell for the equivalent course is never granted, nor will Cornell award more than the number of credits completed at another institution. (Transfer credits from institutions on a trimester or quarter system are not directly comparable to semester credits, and will be reduced when converted to semester credits.)

• The final transfer credit award is recorded by the Engineering Registrar, 158 Olin Hall. Grades for courses taken at other institutions appear on the official Cornell transcript, but are not included in the Cornell cumulative grade point average.

Transfer Credit for Transfer Students

Transfer students entering as first-, second-, or third-year students may transfer up to 36 credits for each year spent in full-time study at another institution, provided that the courses are acceptable for meeting graduation requirements. No more than 72 total transfer credits (combination of those taken both before and after matriculation) may be used to meet graduation requirements. Transfer credits from institutions on the quarter system or trimester system are not directly comparable to semester credits. In general, the number of trimester credits or quarter credits will be reduced when converted to semester credits, and credit will not be given for more than 10 courses per year. Transfer credit awards for matriculating transfer students are evaluated and determined by the undergraduate Major representative in the student’s intended Major of study in engineering.

Transfer students transferring 12 to 23 credits are exempt from one PE course.

Transfer students transferring 24 or more credits are exempt from two PE courses and the swim test.
Transfer Credit to Fulfill the Math Requirement

If transfer credit is given for one or more of the first three math courses (1910, 1920, and 2930 or 2940), the total number of credits for these three courses must be at least 11; otherwise, another math course is required. Transfer credit given for the fourth, Major-dependent, math course must be at least 3 credits.

Transfer Credit for First-Year Students

Students who have taken a course or courses 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 students who indicate that they have taken college-level courses at another institution. These students will be provided additional information by email.

To be eligible to receive transfer credit the following must apply:

• Students must have received at least a grade of C (not C–) in the course, and the subject matter must be applicable to the Engineering curriculum at Cornell.
• Engineering Advising must possess a signed statement (High School Credit Form) from the high school guidance office certifying that the course was not used to fulfill high school graduation credit and that it was taught on a college campus by college faculty and attended by college students. Students who want credit for cooperative courses taken in high school must seek AP credit, not transfer credit
• An official transcript must be received.
• Transfer credit requests must be completed by the end of the first term of residence.

How to Use Advanced Placement or Transfer Credit

Advanced placement (or transfer) credit enables students to begin their college studies at an appropriate level in each subject. They generally profit from these options, but they must judge their own ability to handle a demanding academic program. The advisability of accepting credit depends on many personal factors, such as the extent of study skills, the activities students wish to engage in during their first year, and the thoroughness of their preparation. Whether to accept advanced placement—or take the corresponding course—is a decision for which the student, alone, is responsible.

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. (To be in good standing, enrollment in at least 12 credits each semester is required.)

Further Information

For further information about advanced placement or transfer credit, contact Engineering Advising, College of Engineering, Cornell University, 167 Olin Hall, Ithaca, NY 14853-5201; telephone: 255.7414, email: 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 the requirements will result in a review by the faculty 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 students must have:

- at least 12 credits, including at least two courses in mathematics, science, and engineering (PE courses, and courses below the 1100 level—except ENGRG 1050 and Academic Excellence Workshops (AEWs)—do not count. Military Science courses do not count, with the exception of courses listed under ROTC Courses, page 116);
- at least 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 C– in MATH 1910, 1920, 2930 or 2940, and a math course chosen by the Major. Students failing to meet this requirement must repeat the course immediately and receive a satisfactory grade before enrolling in the next course in the sequence. Failure to achieve at least C– the second time will result in dismissal from the college. Physics and advanced math courses often have math prerequisites, and having to repeat the prerequisite course may delay progress in the physics and math curricula. Students are expected to continue the sequence of core engineering math courses each semester until completed.

Some of the requirements for good standing in Majors are listed below; complete, 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 Major:

**Biological Engineering**
(For all Biological Engineering Majors regardless of the college they are enrolled in)

- Semester GPA ≥ 2.0
- Cumulative GPA ≥ 2.0
• Semester GPA ≥2.0 in biological and environmental engineering courses and engineering distribution courses
• Passing grade in at least 12 credits each semester
• No failing grades

Chemical Engineering
• Semester GPA ≥2.0
• Cumulative GPA ≥2.2
• GPA ≥2.2 each semester in required chemical engineering courses
• At most one grade below C– in required chemical engineering courses during the undergraduate program
• No failing grades

Civil Engineering
• Semester GPA ≥2.0
• Cumulative GPA ≥2.0
• Semester GPA ≥2.0 in core courses, design courses, Major-approved electives, and engineering distribution courses.
• 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 ≥2.3
• Semester GPA ≥2.5 in courses required for the CS Major program, with no course grade less than C–
• No failing grades
• A passing grade in at least 14 credits each semester

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: ECE/ENGRD 2100, ECE 2200, or ECE/ENGRD 2300; (b) all mathematics and physics courses through MATH 2940 and PHYS 2214 by the end of the first semester in the Major (typically the second semester of the second year) and make adequate progress toward the degree in subsequent semesters.
• No failing or missing grades
• Passing grade in at least 12 credits each semester
Engineering Physics
- Semester GPA ≥2.3
- At least C– in all required courses
- No failing grades
- A minimum of 12 credit hours per semester

Environmental Engineering
(For all EnvE Majors regardless of the college in which they are enrolled)
- Semester GPA ≥2.0
- Cumulative GPA ≥2.0
- Semester GPA ≥2.0 in core 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
- Semester GPA ≥2.0
- Cumulative GPA ≥2.0
- A passing grade in at least 12 credits each semester
- No more than one grade below C– in the primary or secondary area during the undergraduate program

Information Science, Systems, and Technology
- Semester GPA ≥2.0
- Semester GPA ≥2.3 in courses used toward the ISST Major and all mathematics courses required by the Engineering college.
- At least C– in ENGRD 2110, ENGRD 2700, and all courses used toward the ISST Major. Note: For each such course, at least C– is required for the course to count toward graduation requirements. If a lower grade is received, the course must be retaken.
- Satisfactory progress (a minimum of 14 credits per semester)
- No failing grades

Materials Science and Engineering
- Semester GPA ≥2.0
- Cumulative GPA ≥2.3
- At most one grade as low as C– in the Major required courses, materials electives, materials applications electives, and the outside technical elective

Mechanical Engineering
- Cumulative GPA ≥2.0
• A passing grade in at least 12 credits each semester, with the exception of the final semester
• At least C– in all ME Major required courses 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 C– in all Operations Research courses, and by the end of the sixth semester, a grade of at least C– in ENGRD 2110
• Satisfactory progress (a minimum of 12 credits per semester)
• No failing grades, no incompletes

Science of Earth Systems
• Semester GPA ≥ 2.0
• Cumulative GPA ≥ 2.0
• At least C– in all required courses

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 departments. Students who fail to meet the conditions for good standing receive written warnings, may be required to take a leave of absence, or may be withdrawn from the college.

A warning should be taken seriously. A student who receives a warning and continues to perform unsatisfactorily may be withdrawn from the degree program. Poor performance also diminishes 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 permitted to enroll in courses at Cornell. They may choose to go to other institutions to retake the courses that caused them difficulty. After a required leave of absence, students may 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). 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. Such 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. The code also appears (along with other campus policies) in the Policy Notebook for the Cornell Community, which is published by the Office of the Dean of Students and distributed to new students. It is available on the web at cuinfo.cornell.edu/Academic/AIC.html. An explanation of all aspects of academic integrity proceedings is available at www.theuniversityfaculty.cornell.edu/AcadInteg/.

The following is taken directly from the code (refer to the documents mentioned above for the entire code): “Absolute integrity is expected of every Cornell student in all academic undertakings ... Academic integrity is expected not only in formal course work situations but in all university relationships and interactions connected to the educational process, including the use of university resources. A Cornell student’s submission of work for academic credit indicates that the work is the student’s own. All outside assistance should be acknowledged, and the student’s academic position truthfully reported at all times. In addition, Cornell students have a right to expect academic integrity from each of their peers.”

The authority to determine whether a specific action shall be treated as a violation of the Code of Academic Integrity lies with the Academic Integrity Hearing Board. Those who violate the Code of Academic Integrity will be subject to penalties under this code and may also be subject to penalties under state and federal laws.

Students and staff members discovering an apparent violation should report the matter to the faculty member in charge of the course or to the chair of the appropriate Hearing Board. Procedures for dealing with alleged academic integrity violations are outlined in the code.

**Dean’s List**

Dean’s List citations are presented each semester to engineering students with exemplary academic records. The criteria for this honor are determined by the dean of the college.

For 2010–2011, the requirement is a semester GPA ≥3.50 (without rounding); no failing, unsatisfactory, missing, or incomplete grades (even in physical education); and at least 12 letter-grade credits (not S/U). Students may earn Dean’s List status retroactively if they meet these criteria after making up incompletes. Students who make the Dean’s List 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 ≥3.50. Cum laude is also awarded to all engineering students who received a semester GPA ≥3.50 in each of the last four semesters of attendance at Cornell; in each of these semesters, at least 12 letter-grade credits must be taken with no failing, unsatisfactory, missing, or incomplete grades. If the student is an Engineering Co-op student, then the Engineering Co-op summer term will count as one of the last four semesters. Students who were approved for prorated tuition in their final semester will be awarded cum laude if they received a semester GPA ≥3.50 in their last semester and meet the conditions above in the prior four semesters.

**Magna cum laude** is awarded to all engineering students with a GPA ≥3.75 (based on all credits taken at Cornell).

**Summa cum laude** is awarded to all engineering students with a GPA ≥4.0 (based on all credits taken at Cornell).

Note: All GPA calculations are minimums and are not rounded.

Major Honors Programs

To enter a Major honors program, a student must be on track to graduate with distinction. A student must be in the program for at least two semesters before graduation. If the student’s Major has an approved honors program and the requirements for (1) distinction, (2) Bachelor of Science degree, and (3) Major honors program are fulfilled, the faculty of the Major may recommend that the student graduate with the notation of “With Honors” on their diploma and transcript.

Biological Engineering (BE) Honors Program

To participate in this Honors Program, students must meet the Major Honors Programs criteria as delineated above, and must have at least 9 credits beyond the minimum required for graduation in BE. 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 4991-4992: 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
The student 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 Honors Program, students must meet the Major Honors Programs
criteria as delineated above. The program consists of at least 9 credits beyond the mini-
imum 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 semes-
  ter). 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
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 pro-
gram. (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 spe-
cific proposed honors program and include the explicit approval of both the faculty advi-
sor and honors advisor. Each program must be approved by the CE Curriculum Commit-
tee, although the committee may delegate approval authority to the associate director for
all but unusual proposals.

Computer Science (CS) Honors Program
To participate in this Honors Program, students must meet the Major Honors Programs
criteria as delineated above and complete at least (9) credits above the minimum required
for completing the major. These nine credits must include:
• At least one CS course (3-credit minimum) at or above the 5000-level with at least
  A– (no seminars or 2-credit project courses).
• At least two 3-credit semesters of CS 4999: Independent Reading and Research with
a CS faculty member with at least an A– each semester.

Content

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

Timing

Candidates are required to send email to ugrad@cs.cornell.edu with the subject line “Honors Candidate”. The deadline for receipt of messages requesting honors is October 15 for May and August candidates and March 15 for January candidates, during or prior to senior year.

Preparation

Arrangements for CS 4999 projects should be made directly with faculty members in the department. Students are encouraged to discuss potential contacts with their advisors and to browse the department’s web page at www.cs.cornell.edu/ for specific leads on research opportunities.

Computer Science reserves the right to make changes in this program at any time.

Engineering Physics (EP) Honors Program

To participate in this Honors Program, students must meet the Major Honors Programs criteria as delineated on page 129.

• Courses counting towards honors cannot be applied to the B.S. degree. The student must complete the following two requirements, which must result in at least 9 credits of work beyond the minimum required for graduation in EP:

  1. Enroll in Independent Study in Engineering Physics, AEP 4900, or an equivalent course, which must be taken for a minimum of 6 credits, over two semesters, for the purpose of completing an independent research project or senior thesis under the supervision of a Cornell engineering or science faculty member. The minimum enrollment is two credits in the first semester and four credits in the second. The level of work required for a successful completion of this project or thesis is to be consistent with the amount of academic credit granted.

  2. The student must enroll in an additional technical course at the 4000 level or above, for at least 3 credits.

Timing

Complete a written application no later than the end of the third week of the first semester of the fourth year, but it is better to make arrangements with a faculty member during the second semester of the third year.

Procedures

Before enrolling in AEP 4900, or the equivalent, 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 re-
search 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 tech-
nical 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 writ-
ten 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
Contact the Undergraduate Program Director of Biological Engineering or the Associate
Director of Civil and Environmental Engineering for information on requirements.

Independent Major (IM) Honors Program
To participate in this Honors Program, students must meet the Major Honors Programs
criteria as delineated on page 129 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
Independent Major Committee by the beginning of the seventh semester.

• Complete an honors thesis involving research of breadth, depth, and quality and
demonstrating professional communication skills.

Information Science, Systems, and Technology (ISST) Honors Program
To participate in this Honors Program, students must meet the Major Honors Programs
criteria as delineated on page 129 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– in each semester
or

• Three credit hours of INFO 4900 with an ISST faculty member and 3 credit hours of
INFO 4910: Teaching in Information Science, Systems, and Technology, both with
at least a grade of A–. It is expected that the INFO 4900 research will result in either
a programming project and/or a written report. Courses at the 5000 or 6000 level
taken to fulfill the honors requirement may be counted toward fulfillment of the pri-
mary or associated option requirements.

The 9 credits work required for honors are in addition to the minimum requirements for
the major.

Materials Science and Engineering (MSE) Honors Program
To participate in this Honors Program, students must meet the Major Honors Programs
criteria as delineated on page 129 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 by the end of week 3 of the first semester of the fourth year, but it is better to make arrangements with a faculty member the semester before that.

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

Operations Research and Engineering (ORE) Honors Program
To participate in this Honors Program, students must meet the Major Honors Programs criteria as delineated on page 129. An honors program shall consist of at least 9 credits beyond the minimum required for graduation in ORE, so that no part of the honors program can also be used to satisfy graduation requirements. The 9 credits shall be from one or more of the following with at least 4 credits from the first category:
• Advanced courses in ORIE at the 5000 level or above.
• A significant research experience or honors project under the direct supervision of an ORIE faculty member using ORIE 4999: ORIE Project. A significant written report must be submitted as part of this component.
• A significant teaching experience under the direct supervision of a faculty member in ORIE using ORIE 4990: Teaching in ORIE.

Timing
Complete a written application no later than the end of the third week of the first semester of the fourth year, 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 (SES) Honors Program
To participate in this Honors Program, students must meet the Major Honors Programs criteria as delineated on page 129 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, and filed with the Program coordinator;

• 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 supervises each honors program. Written approval of the proposal or the thesis by the faculty member who will direct the research is required.
Changes in Status

Petitions to the Faculty

A petition is the official way to request 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 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 health leave of absence based on medical or psychological issues must initiate this leave with Gannett Health Services. The health leave policy can be found at www.gannett.cornell.edu/services/leaveofabsence.cfm.

Leaves of absence last 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 seventh 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. At most 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.

In the College of Engineering, credits earned in extramural courses are counted as transfer credits. Summer-session courses taken at Cornell are not considered transfer credit (see section on transfer credit [page 122] 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 they return. If permission to rejoin is granted, Engineering Advising will respond directly to the student. A student who is rejoining the college 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, students who failed PHYS 1112 in their 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 may 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, 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 students’ faculty advisors, Engineering Advising, and Cornell Career Services in Barnes Hall.
Students interested in transferring within Cornell should consult with the Internal Transfer Division (ITD), 220 Day Hall. The director of ITD can provide expert advising 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 with the ITD 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 sponsorship 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 for sponsorship 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 direct transfer. Students can apply for direct transfer and for sponsorship 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. For complete information and deadlines, please see: http://internaltransfer.cornell.edu/.
Change of Name or Address

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 online through the Student Center on any networked campus terminal. (Public terminals are located outside the University Registrar’s office and in many of the campus libraries and residence halls.) Changes of name or social security number should be submitted in writing to the University Registrar’s office.
Career and Professional Development

From their first year of study, students need to plan for the next stage of life. Some will obtain additional education or training, while others will seek employment immediately after graduation. The College of Engineering and the university provide support for choosing options, 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. Also, in conjunction with Cornell Career Services, an extensive list of electronic job postings is maintained on Cornell Career-Net. 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 111–113) or visit www.engineering.cornell.edu/coop.

Cornell Career Services
103 and 203 Barnes Hall, 255.5221
www.career.cornell.edu

Cornell Career Services (CCS) educates students about the career planning and job-search process and promotes linkages between students and employers or graduate and professional schools. CCS offers a broad range of programs and services that complement those provided in Engineering Cooperative Education and Career Services focusing on five areas:

- Career development—career interest inventories, advising on decisions concerning Majors and careers, and networking opportunities.
- Career information—career library with an extensive collection of print, electronic, audio, and video reference materials on careers and career decision-making; employment; internships; graduate and professional schools; fellowships; and international opportunities to assist students with job searches and applying to graduate and professional schools.
- Job search strategies—job search seminars, employment career fairs, company information sessions, and on-campus interviews. A Career Guide 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 Cornell CareerNet—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 schools.

The Cornell Career Services’ website 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.

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.).

The M.S. and Ph.D. Programs

The M.S. and Ph.D. programs are offered by “Fields of Graduate Study”, which are associated with the Cornell Graduate School. Most engineering fields are directly connected to the obvious department or school, but, because of the interdisciplinary nature of some subjects areas, a field may not be associated with a department or school. The field of Applied Mathematics is an example of this.

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.

To find out about an M.S. or Ph.D. program at Cornell, visit the appropriate department or school, or visit the admissions website of the Cornell Graduate School, www.gradschool.cornell.edu/index.php?p=102.

The Master of Engineering Program

The Master of Engineering (M.Eng.) degree features intensive, one-year professional programs of study built around core courses, a flexible curriculum design, practical interdisciplinary study, and a project, which offer students advanced training in science, current technology, and engineering design. M.Eng. programs are offered in 15 Major fields of study. You can find out about these M.Eng. programs by visiting the M.Eng. website, www.engineering.cornell.edu/meng, or the appropriate engineering department or school.

At the beginning of their senior year, qualified engineering students may request an early decision (by December of the senior year) on admission to the M.Eng. program. The early decision option may help them with decision-making as they near completion of the bachelor in science degree. Information on Early Decision is available through the Graduate Field Offices.

Qualified students may enroll simultaneously in the M.Eng. program in their eighth semester, while completing their B.S. degree, provided they need at most 8 credits to complete their B.S. degree. The grades of M.Eng. courses taken during the early-admission semester will count toward a student’s undergraduate GPA. Applicants must have a cumulative GPA ≥2.7 at the time of application and must submit an “Early Admission Petition and Course Record Form” with their application. All requirements for the B.S. degree must be completed before enrolling fully as a graduate student in the M.Eng. program, and at least one semester as a full-time M.Eng. student is required. The form for Early Admission is available in all Graduate Field Offices and at the Office of Research and Graduate Studies, 222 Carpenter Hall.
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 multistep 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.

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 at www.op.nysed.gov/prof/pels/.

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.
Student Organizations

Student organizations in Engineering help connect classroom and career, develop professionalism, increase technical proficiency, and refine ethical judgment. Some organizations are involved in community service; many involve teams that compete in intramural soccer, football, hockey, and softball games; and a few manage coffee shops on weekday mornings in the departmental lounges. A complete listing of student organizations is available here: sao.cornell.edu/SO/.

Alpha Epsilon
c/o Professor Jim Bartsch, 314 Riley-Robb Hall
National honor society of agricultural, food, and biological engineering.

Alpha Sigma Mu
c/o Professor Shefford Baker, 329 Thurston Hall
Honorary society for students in materials engineering.

American Association of Petroleum Geologists (AAPG)
c/o Professor Teresa Jordan, 4108 Snee Hall

American Indian Science and Engineering Society (AISES)
c/o Diversity Programs in Engineering Office, 146 Olin Hall
http://aip.cornell.edu/cals/aip/student-life/organizations/aises/index.cfm

American Institute of Aeronautics and Astronautics (AIAA)
108 Upson Hall

American Institute of Chemical Engineers (AIChE)
120 Olin Hall, aiche@cornell.edu
www.rso.cornell.edu/aiche

American Society of Civil Engineers (ASCE)
c/o Professor Jery Stedinger, 213 Hollister Hall

American Society of Mechanical Engineers (ASME)
108 Upson Hall
www.rso.cornell.edu/ASME/

Association of Computer Science Undergraduates (ACSU)
c/o Nicole Roy, 303 Upson Hall
acsu.cornell.edu

Biomedical Engineering Society (BMES)
c/o Professor Chris Schaffer, B57 Weill Hall
Student chapter of the national BMES
www.rso.cornell.edu/bmes/

Chi Epsilon
c/o Professor James M. Gossett, 215 Hollister Hall
Student chapter of the national honor society in civil engineering.
Cornell AEP Society (CAEPS)  
c/o Professor Chris Xu, 212 Clark Hall  
Student organization of the School of Applied and Engineering Physics.

Cornell Chapter of the American Meteorological Society (CCAMS)  
c/o Mark W. Wysocki, 1114 Bradfield Hall  
ccams.eas.cornell.edu/

Cornell Materials Society (CMS)  
c/o Professor Michael Thompson, 328 Bard Hall  

Digital Gaming Alliance (DGA)  
c/o Walker White, 4122 Upson Hall  
The video games club at Cornell.  
cornellgaming.org/

Encourage Young Engineering Students (EYES)  
Public Service Center, 200 Barnes Hall  
Committed to increasing the mathematics and science skills of evolving elementary, middle, and high school students.

Engineering Ambassadors Association  
102 Hollister Hall  
Introduces prospective first-year students to the College of Engineering  
www.ea.cornell.edu

Engineering Representative to the Student Assembly  
Engineering Student Assembly, Office of the Assemblies, 165 Day Hall

Engineers for a Sustainable World (ESW)  
c/o Professor Park Doing, 396 Rhodes Hall  
Dedicated to building a more sustainable world.  
www.rso.cornell.edu/esw

Eta Kappa Nu (HKN)  
c/o Clifford Pollock  
224 Phillips Hall  
Student chapter of the electrical and computer engineering honor society.

Information Science Student Association (ISSA)  
c/o Christine Stenglein, 303 Upson Hall  
rso.cornell.edu/issa/

Institute of Biological Engineering (IBE)  
c/o Professor John March, 220 Riley-Robb Hall  
Student chapter of the national IBE.  
www.rso.cornell.edu/ibe/
Institute of Electrical and Electronics Engineers (IEEE)
c/o John Belina, 201 Phillips Hall
Student chapter of the national IEEE.

Institute for Operations Research and the Management Sciences (INFORMS)
c/o Cindy Jay, 203 Rhodes Hall
Student chapter of the national INFORMS.

National Society of Black Engineers (NSBE)
c/o Diversity Programs in Engineering Office, 146 Olin Hall
nsbe.cornell.edu

Omega Rho International Honor Society
c/o ORE, 203 Rhodes Hall
Student chapter of the Omega Rho International Honor Society.

Peer Advisor Program
c/o Engineering Advising, 167 Olin Hall
Helps first-year engineering students adjust to life at Cornell and Engineering.

Pi Tau Sigma
108 Upson Hall
Student chapter of the honorary mechanical engineering society.

Society of Automotive Engineers (SAE)
c/o Professor Albert George, 208 Upson Hall

Society of Hispanic Professional Engineers (SHPE)
c/o Diversity Programs in Engineering Office, 146 Olin Hall
shpe.cornell.edu

Society of Women Engineers (SWE)
c/o Diversity Programs in Engineering Office, 146 Olin Hall
www.swe.cornell.edu/

Tau Beta Pi
c/o John Belina, 201 Phillips Hall
Student chapter of the national engineering honor society.
rso.cornell.edu/tbp/
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