

College of Engineering

Degree Programs

Cornell programs in engineering and applied science lead to the degrees of bachelor of science (B.S.), master of engineering (with field designation) (M.Eng.), master of science (M.S.), and doctor of philosophy (Ph.D.).

Many students stay a fifth year in the College of Engineering to pursue a professional degree, the master of engineering (M.Eng.) degree. Joint enrollment in the B.S. and M.Eng. degrees is possible for students in their last semester who lack only 1 to 8 credits for the B.S.

Programs leading to the M.S. and Ph.D. degrees are administered by the Graduate School. They are described in the Announcement of the Graduate School and the special announcement Graduate Study in Engineering and Applied Science.

For information about graduation requirements, intro and distribution courses, first-year requirements, subjects and scores for CEEB and AP exams, distinction and honors, transfer, etc., see:

<http://cuinfo.cornell.edu/Academic/Courses/ENG.php>

Affiliation with a Major:

Science of Earth Systems requires:

Good academic standing in the College of Engineering.

Engineering Majors

This section describes the majors in the College of Engineering: the programs in which an undergraduate can study to obtain a B.S. degree. A basic requirement of any major is a GPA ≥ 2.0 . Most majors have a higher GPA requirement and may have other requirements.

Honors Program within Majors:

Many of the engineering majors supplement the major with an honors program.

Eligibility

The B.S. degree with honors is granted to engineering students who, in addition to having completed the requirements for a B.S. degree in a major, satisfactorily complete the honors program in the major and are recommended for the degree by the honors committee of that major. To enter an honors program, the student must be on track to graduate with distinction, and a student who does not stay on track to graduate with distinction is dropped from the honors program.

Courses taken to satisfy the honors requirement may not be used to satisfy B.S. degree requirements. At least 9 extra credit hours are required, and a student must be in the program for at least two semesters before graduation.

No research, independent study, or teaching for which the student is paid may be counted toward the honors program.

Procedures

An applicant to the honors program in a major must have an honors advisor: a faculty member from that major who will supervise the honors program and direct the research or project. The honors advisor need not be the student's advisor in the major.

The application for the honors program should be a letter from the student that describes the proposed honors program in detail and includes the explicit approval of the honors advisor.

Students must complete a written application no later than the beginning of the first semester of their senior year, but they are encouraged to make arrangements with the honors advisor during the second semester of their junior year. Each major may place further constraints on timing.

Major-Specific Information

Each major defines the content of the honors program and may also place other requirements on the program, in terms of timing, content, and procedures. Information is given within the description of the individual majors.

SCIENCE OF EARTH SYSTEMS

Offered by the Department of Earth and Atmospheric Sciences

Contact: 2124 Snee Hall, 255-5466, <http://www.eas.cornell.edu>

We live on a planet with finite resources and a finite capacity to recover quickly from human-induced environmental stresses. Natural hazards such as earthquakes, hurricanes, and volcanic eruptions can alter the course of history with little prior warning. As the human population grows, understanding the Earth and its resources becomes progressively more important to both future policymakers and ordinary citizens, who must find new sources of energy and sustain the quality of our environment. Because the human need to understand the Earth is so pervasive and the earth system is so multifaceted, the major covers the spectrum of modern earth sciences, including the structure, composition, and evolution of our planet; the planetary processes producing weather and climate; and processes on and near the earth's surface where the interactions of water, life, rock, and air produce our planetary environment.

The major is built on a rigorous introduction to this broad spectrum plus a concentration chosen by the student to obtain expertise in an area of interest and relevance to the student's career plans.

The major prepares students for a number of career paths including further graduate study in geology, geophysics, geochemistry, biogeochemistry, atmospheric sciences, ocean sciences, hydrology, or environmental sciences and engineering. Careers dealing with energy and mineral resources, natural hazards, weather and climate, ocean sciences, or environmental sciences are possible in academic research groups, governmental agencies, and the private sector. The major also prepares students for careers in environmental policy, law or medicine, science in the media, and K-12 science teaching.

Requirements for the Major

This major has the same requirements as the Science of Earth Systems major in other Cornell undergraduate colleges. The major includes strong preparation in math, physics, chemistry, and biology. A second semester of chemistry (CHEM 2080 or CHEM 1570) is required with PHYS 2214 optional. Two semesters of biology are required (either BIOG 1101/1103-1102/1104 or BIOG 1109-1110). A second semester of biology can be replaced by CHEM 1570 if CHEM 2080 is also selected.

A required introductory course in earth science is satisfied by EAS 2200.

The core courses emphasize the interconnectedness of the Earth system, and are founded on the most modern views of the planet as an interactive and ever-changing system. Each crosses the traditional boundaries of disciplinary science. The major requires three of the following four core courses.

- EAS 3010 Evolution of the Earth System
- EAS 3030 Biogeochemistry
- EAS 3040 Interior of the Earth
- EAS 3050 Climate Dynamics

The concentration is achieved by completion of four intermediate to advanced-level courses (3000 level and up) that build on the core courses and have prerequisites in the required basic sciences and mathematics courses. Note that additional basic math and science courses may be required to complete the concentration courses, depending upon the student's choice of concentration. The concentration courses build depth and provide the student with a specific expertise in some facet of Earth system science. Four defined areas of specialization include geology, biogeochemistry, atmospheric sciences, and ocean sciences. Students may also design other concentrations. Examples include planetary science, ecological systems, geohydrology, and soil science. The concentration should be chosen during the junior year or before in consultation with the student's advisor and with approval of the Director of Undergraduate Studies. For concentrations beyond the four first named, approval by the SES Curriculum Committee is needed.

Exposure to the basic observations of earth science, whether directly in the out-of-doors, or indirectly by the many advanced techniques of remote sensing of our planet, or in the laboratory, is necessary to understand fully the chosen area of concentration in the major. Three credits of appropriate course work are required. Possibilities include the following:

Courses in the Hawaii Environmental Semester Program; or Courses given by the Shoals Marine Laboratory; or EAS 2500 Meteorological Observations and Instruments; or EAS 3520 Synoptic Meteorology I; or EAS 4170 Field Mapping in Argentina EAS 4370 Geophysical Field Methods; or EAS 4910 and/or EAS 4920 Undergraduate Research with appropriate choice of project; or Field course or courses taught by another college or university (e.g. Semester at Sea).

Students should discuss with their faculty advisor whether the fourth core course listed above or the course used to fulfill the observation/field requirement may also be used to satisfy the concentration.

For more information contact Professor John Cisne, Department of Earth and Atmospheric Sciences, john.cisne@cornell.edu, or visit <http://www.eas.cornell.edu>.

Field Study in Hawaii

Field study is a fundamental aspect of earth system science. Students wishing to increase their field experience may fulfill some of the requirements for the Science of Earth Systems major by off-campus study through the Cornell Earth and Environmental Semester program (EES). The EES program, offered during the spring semester, emphasizes field-based education and research. It is based on the island of Hawaii, an outstanding natural laboratory for earth and environmental sciences. Courses that may be applied to the Science of Earth Systems major include EAS 3400, 3220, and 3510. The EES program also offers opportunities for internships with various academic, nonprofit, and government organizations. Typically, students participate in the EES program during their junior year, although exceptions are possible. For further information, see <http://www.geo.cornell.edu/geology/classes/hawaii/>.

Science of Earth Systems Honors Program

The B.S. degree with honors is granted to engineering students who satisfy the requirements given at the beginning of the section “Engineering Majors” as well as the requirements of an honors thesis involving research (EAS 4910–4920 or 4990, 2 or more credits each) of breadth, depth, and quality. A written proposal of the honors project must be accepted by the student’s advisor and the director of undergraduate studies early in the first semester of the student’s senior year.

Engineering Minors

Students may pursue minors in any department in any college that offers them, subject to limitations placed by the department offering the minor or by the students’ major. Completed minors will appear on the student’s transcript. Not all departments offer minors. Consult the appropriate section in Courses of Study or contact the appropriate department for information on minors offered and how to pursue a minor.

An engineering minor recognizes formal study of a particular subject area in engineering normally outside the major. Students undertaking a minor are expected to complete the requirements during the time of their continuous undergraduate enrollment at Cornell. Completing the requirements for an engineering minor (along with a major) may require more than the traditional eight semesters at Cornell. However, courses that fulfill minor requirements may also satisfy other degree requirements (e.g., distribution courses, advisor-approved, or major-approved electives), and completion within eight semesters is possible.

An Engineering Minor Requires:

- successful completion of all requirements for an undergraduate degree.
- enrollment in a major that approves participation in the minor.
- satisfactory completion of six courses (at least 18 credits) in a college-approved minor.

Students may apply for certification of a minor at any time after the required course work has been completed in accordance with published standards. An official notation of certification of a minor appears on the Cornell transcript following graduation.

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

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

Additional information on specific minors can be found below, in the Engineering Undergraduate Handbook, in the undergraduate major office of the department or school offering the minor, and in Engineering Advising.

Minor: Science of Earth Systems

Offered by the Department of Earth and Atmospheric Sciences

Contact: 2124 Snee Hall, 255-5466, <http://www.eas.cornell.edu>

Students affiliated with all majors except science of earth systems are eligible to participate.

Some of the major problems facing mankind in this century involve earth science, especially the generation of new energy sources for a growing world population, and engineers 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.

Academic standards: At least C– in each course in the minor. GPA \geq 2.0 for all courses in the minor.

Requirements

At least six courses (\geq 18 credits), chosen as follows:

1. EAS 2200 The Earth System
2. At least two of these 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, e.g., additional courses from the above lists, undergraduate research courses, and outdoor field courses.

MASTER OF ENGINEERING (GEOLOGICAL SCIENCES)

Offered by the Department of Earth and Atmospheric Sciences

Contact: 2124 Snee Hall, 255-5466, <http://www.eas.cornell.edu>

The one-year MEng. (Geological Sciences) degree program provides future professional geologists or engineers with the geological and engineering background they will need to analyze and solve engineering problems that involve geological variables and concepts. Individual programs are developed within two established options: geohydrology and environmental geophysics.

Incoming students are expected to have a strong background in mathematics, the physical sciences, and chemistry and have a strong interest and substantial background in the geological sciences. The 30-hour M.Eng. program is intended to extend and broaden this background to develop competence in four subject categories. Typical categories for the geohydrology option are porous media flow, geology, geochemistry, and numerical modeling. Typical categories for the environmental geophysics option are geophysics, geology, porous media fluid flow, and computer methods. The courses a student selects in a category will vary depending on the student's background. No courses may be required in some categories, and the categories can be adjusted to the student's interest and needs. Alternatives to numerical modeling in the geohydrology option could be economics or biochemistry, for example. To count toward the 30-credit degree requirement, courses must be at a graduate or advanced undergraduate level.

At least 10 of the 30 hours in the program must involve engineering design. Much of this requirement is normally met through a design project, which can account for over a third of the program (12 of 30 credits) and must constitute at least 3 credits. The design project must involve a significant geological component and lead to concrete conclusions or recommendations of an engineering nature. The project topic can be drawn from a student's nonacademic work experience but carried out or further developed with advice from a Cornell faculty member with expertise in the project area selected by the student. A design project in geohydrology would normally involve groundwater flow and mass transport. A design project in environmental geophysics might involve implementation of a field survey using seismological, geoelectrical, or ground-penetrating radar methods to map subsurface stratigraphic or structural features that control groundwater flow or contamination at a site. Projects are presented both in written form and orally in a design seminar at the end of the year.