THE WiESS SCHOOL OF NATURAL SCIENCES

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ESCI Degrees Offered: BA, BS, MS, PhD

All undergraduate majors in earth science take a 4-course core sequence, typically in the sophomore and junior years, on earth processes, materials, observations, and history. Majors also take introductory courses in mathematics, chemistry, and in many cases, physics and biology.

The selection of upper-division courses and additional science courses depends on which major, BA or BS, and, for the BS major, which of five tracks are chosen by the student: geology, geochemistry, geophysics, environmental earth science, or a track designed by the student subject to the approval of the Department Undergraduate Adviser. The program of study typically includes experience with analytical equipment, computer systems, and fieldwork.

The BS in earth science degree should be chosen by students planning a career or further study in earth science or a related field. The BA in earth science degree has fewer requirements and might be a good choice for students planning a career or further study to which earth science is incidental.

Degree Requirements for BS in Earth Science

For general university requirements, see Graduation Requirements (pages 14–15). BS majors must also complete the “Additional Requirements” for one track (described below).

The following courses are required for all tracks:

MATH 101/102 Single Variable Calculus I and II
CHEM 121/122 or 151/152 General Chemistry I and II with lab
PHYS 101/102 or 111/112 Introductory Physics I and II with lab

ESCI 321 Earth System Evolution and Cycles
ESCI 322 Earth Chemistry and Materials
ESCI 323 Earth Structure and Deformation with lab
ESCI 324 Earth’s Interior
Additional Requirements for the Geology Track

**The following courses are required:**

- MATH 211 Ordinary Differential Equations and Linear Algebra
- ESCI 334 Geological and Geophysical Techniques
- ESCI 390 Field Camp

**Choose one of the following courses:**

- COMP 110 Computation in Natural Science
- CAAM 210 Introduction to Engineering Computation (FORTRAN)
- CAAM 211 Introduction to Engineering Computation (C)
- COMP 210 Principles of Computing and Programming

**Choose one of the following courses:**

- ESCI 412 Advanced Petrology
- ESCI 430 Principles of Trace-Element and Isotope Geochemistry

**Additional Requirements for the Geochemistry Track**

**The following courses are required:**

- BIOS 201 Introductory Biology I
- A 6 hour field-based course or equivalent, approved by the department undergraduate adviser

**Choose 9 hours from the following:**

- ESCI 412 Advanced Petrology
- ESCI 421 Paleooceanography
- ESCI 458 Thermodynamics/Kinetics for Geoscientists
- ESCI 203 Biogeochemistry
- ESCI 430 Principles of Trace-Element and Isotope Geochemistry

**Choose 9 hours from the following:**

- All upper division ESCI courses
- CEVE 401 Introduction to Environmental Chemistry
- CEVE 403 Principles of Environmental Engineering
- CEVE 434 Chemical Transport and Fate in the Environment
- CEVE 532 Physical-Chemical Processes in Environmental Engineering

- CEVE 534 Transport Phenomena and Environmental Modeling
- CEVE 550 Environmental Organic Chemistry
- BIOS 202 Introductory Biology
- BIOS 211 Introductory Lab Module in Biological Science
- CHEM 211/212 Organic Chemistry
- CHEM 311/312 Physical Chemistry
- CHEM 415 Chemical Kinetics and Dynamics
- CHEM 495 Transition Metal Chemistry
- MATH 211 Ordinary Differential Equations and Linear Algebra
- MATH 212 Multivariable Calculus
- COMP 110 Computation Science and Engineering
- CAAM 210/211 Introduction to Engineering Computation
- COMP 210 Introduction to Principles of Scientific Computing
Additional Requirements for the Geophysics Track

The following courses are required:
MATH 211 Ordinary Differential Equations and Linear Algebra
MATH 212 Multivariable Calculus
PHYS 201 Waves and Optics
PHYS 231 Elementary Physics Lab II

In addition, the student must complete a field experience, equivalent to 6 semester hours, approved by the department undergraduate advisor.

Choose one of the following courses:
COMP 110 Computation in Natural Science
CAAM 210 Introduction to Engineering Computation (FORTRAN)
CAAM 211 Introduction to Engineering Computation (C)
COMP 210 Principles of Computing and Programming

Choose 6 hours from the following:
ESCI 440 Geophysical Data Analysis: Digital Signal Processing
ESCI 441 Geophysical Data Analysis: Inverse Theory
ESCI 442 Exploration Geophysics I
ESCI 444 Exploration Geophysics II
ESCI 450 Remote Sensing
ESCI 454 Geographic Information Science
ESCI 461 Seismology I
ESCI 462 Tectonophysics
ESCI 464 Global Tectonics
ESCI 532 Advanced Global Tectonics
ESCI 542 Seismology II

Choose 6 hours from the immediately preceding or following lists:
Any 3- or 4-hour course in ESCI with a number between 411 and 475, except for research and special studies
Any 300- or 400-level MATH, CAAM, or PHYS class
CHEM 311 Physical Chemistry
CEVE 412 Hydrology & Watershed Analysis

Additional Requirements for the Environmental Earth Science Track

The following courses are required:
MATH 211 Ordinary Differential Equations and Linear Algebra
BIOS 201 Introductory Biology I

Choose one of the following courses:
COMP 110 Computation in Natural Science
CAAM 210 Introduction to Engineering Computation (FORTRAN)
CAAM 211 Introduction to Engineering Computation (C)
COMP 210 Principles of Computing and Programming

Choose 14 hours from the following, including at least two courses in ESCI:
ESCI 451 Analysis of Environmental Data
ESCI 353 Environmental Geochemistry
ESCI 442 Exploration Geophysics
ESCI 454 Geographic Information Science
ESCI 463 Advanced Structural Geology I
ESCI 504 Clastics
ESCI 506 Carbonates
ESCI 568 Paleoclimates and Human Response
CEVE 306 Global Environmental Law and Sustainable Development
CEVE 434 Chemical Transport and Fate in the Environment
CEVE 412 Hydrogeology and Watershed Analysis
CEVE 401 Environmental Chemistry
CHEM 211 Organic Chemistry
CHEM 311 Physical Chemistry
CHEM 360 Inorganic Chemistry
PHYS 201 Waves and Optics
PHYS 231 Elementary Physics Lab II
BIOS 202 Introductory Biology II
**Additional Requirements for the Self-Designed Track**

The department recognizes the interdisciplinary nature of modern earth science and the opportunity for students to specialize in nontraditional and emerging fields. Therefore, students can design their own specialty track, normally in close consultation with one faculty member and followed by approval from the department undergraduate adviser. In addition to required earth science courses and related courses, these tracks will generally comprise 15 additional hours that target a coherent theme from an approved list of 300- or higher-level courses, from inside or outside the department. Interested students are expected to submit a statement of rationale by the beginning of their third year.

### Choose 9 hours from the following:

- BIOS 201 *Introductory Biology I*
- COMP 110 *Computation in Natural Science*
- CAAM 210 *Introduction to Engineering Computation (FORTRAN)*
- CAAM 211 *Introduction to Engineering Computation (C)*
- COMP 210 *Principles of Computing and Programming*
- CHEM 311/312 *Physical Chemistry I and II*
- MATH 211 *Ordinary Differential Equations and Linear Algebra*

### Degree Requirements for BA in Earth Science

For general university requirements, see Graduation Requirements (pages 14–15).

### The following courses are required:

- MATH 101/102 *Single Variable Calculus I and II*
- CHEM 121/122 or 151/152 *General Chemistry I and II with lab*
- ESCI 321 *Earth System Evolution and Cycles*
- ESCI 322 *Earth Chemistry and Materials*
- ESCI 323 *Earth Structure and Deformation with lab*
- ESCI 324 *Earth’s Interior*
- ESCI 334 *Geological and Geophysical Techniques*

### Choose 6 hours from the following:

- BIOL 201/202 *Introductory Biology I and II*
- BIOL 211, 213 *Biology Lab Modules*

### Undergraduate Independent Research

The department encourages, but does not require, earth science undergraduate majors to pursue independent supervised research in ESCI 481 *Research in Earth Science*. See also Honors Programs (page 26).
Degree Requirements for MS and PhD in Earth Science

All incoming students should have a strong background in physics, chemistry, and mathematics and should have, or should acquire, a broad grounding in fundamental earth science. The department encourages applications from well-qualified students with degrees in the other sciences and mathematics. For general university requirements, see Graduate Degrees (pages 57–58). The requirements for the MS and PhD in earth science are similar, but the PhD demands a significantly higher level of knowledge, research skills, and scholarly independence. Most students need at least two years beyond the bachelor’s degree to complete the MS and at least two years beyond the MS degree for the PhD.

Candidates determine, with their major professor and thesis committee, a course of study following the Guidelines for Advanced Degrees in the Department of Earth Science distributed to all incoming students. For both degrees, candidates must:

- Complete 20 semester hours of course work at the 400 level and above (or other approved courses), not including research hours
- Pass a written preliminary exam
- Maintain a grade point average of 3.00 (B) or better
- Prepare a written thesis
- Produce a publishable thesis that represents an original contribution to science
- Defend the research and conclusions of the thesis in an oral examination

Students of exceptional ability with a bachelor’s degree and department approval may work directly toward the PhD, in which case the course of study is equivalent to that required for both degrees; performance on the examinations and the thesis, however, should be at the level required for the PhD. Because the graduate programs require full-time study and close interaction with faculty and fellow students, the department discourages students from holding full (or nearly full) time jobs outside the university. Outside employment must be approved by the chair.

See ESCI in the Courses of Instruction section.