ESC1 Degrees Offered: BA, BS, MS, PhD

All undergraduate majors in earth science take a four-course core sequence, typically in the sophomore and junior years, on earth processes, materials, observations, and history. Majors also take a course in geological field techniques and 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 advisor. 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 (Undergraduate Students section, pages 2–5).

BS majors also must complete the “Additional Requirements” for one track (described below).

<table>
<thead>
<tr>
<th>The following courses are required for all tracks:</th>
<th>Choose one of the following courses:</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 101/102 Single Variable Calculus I and II</td>
<td>ESCI 321 Earth System Evolution and Cycles</td>
</tr>
<tr>
<td>CHEM 121/122 or 151/152 General Chemistry I and II with lab</td>
<td>ESCI 322 Earth Chemistry and Materials</td>
</tr>
<tr>
<td>PHYS 101/102 or 111/112 Introductory Physics I and II with lab</td>
<td>ESCI 323 Earth Structure and Deformation with lab</td>
</tr>
<tr>
<td>ESCI 324 Earth’s Interior</td>
<td></td>
</tr>
<tr>
<td>ESCI 334 Geological and Geophysical Techniques</td>
<td></td>
</tr>
</tbody>
</table>

**Additional Requirements for the Geology Track**

<table>
<thead>
<tr>
<th>The following courses are required:</th>
<th>Choose one of the following courses:</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 211 Ordinary Differential Equations and Linear Algebra</td>
<td>ESCI 427 Sequence Stratigraphy</td>
</tr>
<tr>
<td>ESCI 390 Geology Field Camp</td>
<td></td>
</tr>
<tr>
<td>ESCI 442 Exploration Geophysics I</td>
<td>ESCI 504 Siliciclastic Depositional Systems</td>
</tr>
<tr>
<td><strong>Choose one of the following courses:</strong></td>
<td>ESCI 506 Carbonate Depositional Systems</td>
</tr>
<tr>
<td>COMP 110 Computation in Natural Science</td>
<td>ESCI 421 Paleoeceanography</td>
</tr>
<tr>
<td>CAAM 210 Introduction to Engineering Computation</td>
<td><strong>Choose one of the following courses:</strong></td>
</tr>
<tr>
<td><strong>Choose one of the following courses:</strong></td>
<td>ESCI 410 Optical Mineralogy and Petrography</td>
</tr>
<tr>
<td>ESCI 412 Advanced Petrology</td>
<td>ESCI 418 Quantitative Hydrogeology</td>
</tr>
<tr>
<td>ESCI 430 Principles of Trace-Element and Isotope Geochemistry</td>
<td>ESCI 465 Advanced Structural Geology</td>
</tr>
<tr>
<td><strong>Choose eight hours from the following:</strong></td>
<td>ESCI 428 Geologic Interpretation of Reflection Seismic Profiles</td>
</tr>
<tr>
<td>All upper division ESCI courses</td>
<td>ESCI 464 Global Tectonics</td>
</tr>
<tr>
<td>CEVE 401 Introduction to Environmental Chemistry</td>
<td><strong>Choose eight hours from the following:</strong></td>
</tr>
<tr>
<td>CEVE 403 Principles of Environmental Engineering</td>
<td>All upper division ESCI courses</td>
</tr>
<tr>
<td>CEVE 434 Chemical Transport and Fate in the Environment</td>
<td>CEVE 532 Physical-Chemical Processes in Environmental Engineering</td>
</tr>
</tbody>
</table>

**Additional Requirements for the Geochemistry Track**

<table>
<thead>
<tr>
<th>The following courses are required:</th>
<th>Choose eight hours from the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOC 201 Introductory Biology</td>
<td>All upper division ESCI courses</td>
</tr>
<tr>
<td>ESCI 390 Geology Field Camp or</td>
<td>CEVE 401 Introduction to Environmental Chemistry</td>
</tr>
<tr>
<td>ESCI 391 Earth Science Field Experience</td>
<td>CEVE 403 Principles of Environmental Engineering</td>
</tr>
<tr>
<td><strong>Choose nine hours from the following:</strong></td>
<td>CEVE 434 Chemical Transport and Fate in the Environment</td>
</tr>
<tr>
<td>ESCI 340 Global Biogeochemical Cycles</td>
<td>CEVE 532 Physical-Chemical Processes in Environmental Engineering</td>
</tr>
<tr>
<td>ESCI 412 Advanced Petrology</td>
<td><strong>Choose eight hours from the following:</strong></td>
</tr>
<tr>
<td>ESCI 419 Materials Characterization</td>
<td>All upper division ESCI courses</td>
</tr>
<tr>
<td>ESCI 421 Paleoeceanography</td>
<td>CEVE 401 Introduction to Environmental Chemistry</td>
</tr>
<tr>
<td>ESCI 425 Organic Geochemistry</td>
<td>CEVE 403 Principles of Environmental Engineering</td>
</tr>
<tr>
<td>ESCI 458 Thermodynamics/Kinetics for Geoscientists</td>
<td>CEVE 434 Chemical Transport and Fate in the Environment</td>
</tr>
<tr>
<td><strong>Choose eight hours from the following:</strong></td>
<td>CEVE 532 Physical-Chemical Processes in Environmental Engineering</td>
</tr>
<tr>
<td>All upper division ESCI courses</td>
<td><strong>Choose eight hours from the following:</strong></td>
</tr>
<tr>
<td>CEVE 401 Introduction to Environmental Chemistry</td>
<td>All upper division ESCI courses</td>
</tr>
<tr>
<td>CEVE 403 Principles of Environmental Engineering</td>
<td>CEVE 434 Chemical Transport and Fate in the Environment</td>
</tr>
<tr>
<td>CEVE 532 Physical-Chemical Processes in Environmental Engineering</td>
<td><strong>Choose eight hours from the following:</strong></td>
</tr>
<tr>
<td>All upper division ESCI courses</td>
<td>All upper division ESCI courses</td>
</tr>
</tbody>
</table>
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
ESCI 390 Geology Field Camp or
ESCI 391 Earth Science Field Experience

Choose one of the following courses:
COMP 110 Computation in Natural Science
CAAM 210 Introduction to Engineering Computation

Choose six hours from the following:
ESCI 418 Quantitative Hydrogeology
ESCI 440 Geophysical Data Analysis: Digital Signal Processing

Additional Requirements for the Environmental Earth Science Track

The following courses are required:
MATH 211 Ordinary Differential Equations and Linear Algebra
BIOC 201 Introductory Biology
ESCI 390 Geology Field Camp or ESCI 391 Earth Science Field Experience
STAT 280 Elementary Applied Statistics

Choose one of the following courses:
COMP 110 Computation in Natural Science
CAAM 210 Introduction to Engineering Computation

Choose 11 hours from the following, including at least two courses in ESCI:
ESCI 340 Global Biogeochemical Cycles
ESCI 414 Physics and Chemistry of the Atmosphere
ESCI 418 Quantitative Hydrogeology
ESCI 419 Materials Characterization
ESCI 425 Organic Geochemistry
ESCI 442 Exploration Geophysics
ESCI 450 Remote Sensing
ESCI 454 Geographic Information Science
ESCI 461 Seismology I
ESCI 462 Tectonophysics
ESCI 464 Global Tectonics
ESCI 542 Seismology II
CEVE 534 Transport Phenomena and Environmental Modeling
CEVE 550 Environmental 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 Introduction to Engineering Computation

Any three- or four-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 306 Global Environmental Law and Sustainable Development
CEVE 401 Environmental Chemistry
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 six hours from the following:

- BIOC 201 and EBIO 202 Introductory Biology
- MATH 211 Differential Equations
- PHYS 101/102 or 125/126 Introductory Physics
- COMP 110 Computation in Natural Science
- CAAM 210 Introduction to Engineering Computation

Choose 18 hours of additional courses numbered 300 or higher targeting a coherent theme selected with approval of the department undergraduate advisor.

Degree Requirements for BA in Earth Science

For general university requirements, see Graduation Requirements (Undergraduate Students section, pages 2–5).

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 six hours from the following:

- BIOC 201 and EBIO 202 Introductory Biology
- MATH 211 and EBIO 213 Biology Lab Modules
- CEVE 406 Introduction to Environmental Law
- CEVE 412 Hydrogeology and Watershed Analysis
- CEVE 434 Chemical Transport and Fate in the Environment
- CHEM 211 Organic Chemistry
- PHYS 201 Waves and Optics
- PHYS 231 Elementary Physics Lab II
- E BIO 202 Introductory Biology
- CHEM 311 Physical Chemistry
- CHEM 360 Inorganic Chemistry
- CEVE 412 Hydrogeology and Watershed Analysis
- CEVE 434 Chemical Transport and Fate in the Environment
- CHEM 211 Organic Chemistry
- MATH 211 Differential Equations
- PHYS 101/102 or 125/126 Introductory Physics
- COMP 110 Computation in Natural Science
- CAAM 210 Introduction to Engineering Computation
- Choose four upper division ESCI courses, approved by the department undergraduate advisor.

Choose six hours in science and engineering (including ESCI) courses at the 200 level or above approved by the department undergraduate advisor.
**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 (Undergraduate Students section, pages 15).

**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, mathematics, or engineering. For general university requirements, see Graduate Degrees (Graduate Student section, pages 3–4). 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 or four to complete 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 comprised of peer-reviewed publication(s) that represent an original contribution to science
- Defend the research and conclusions of the thesis in an oral examination

Students 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.