Twin Cities Campus

Earth Sciences B.S. Earth Sciences

Department of Earth Sciences

College of Science and Engineering

- Program Type: Baccalaureate
- Requirements for this program are current for Fall 2021
- Required credits to graduate with this degree: 120
- Required credits within the major: 93
- This program requires summer terms.
- NA
- Degree: Bachelor of Science in Earth Sciences

Earth sciences is the study of the composition, structure, and history of the Earth and of the processes that operate on and within it, with emphasis on the crust, oceans, and atmosphere. The department's programs emphasize applications of physics, chemistry, and biology to understanding the Earth.

Earth scientists are employed in a wide range of fields, including exploration for and development of natural resources (hydrocarbons, minerals, groundwater); environmental science; urban planning; education; and oceanography. Potential employers include the oil, gas, and minerals industries; environmental consultants; federal and private research institutions; universities; schools; and government agencies. An advanced degree is usually required for a career in research or teaching.

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Admission Requirements

Students must complete 8 courses before admission to the program.

Freshman and transfer students students are usually admitted to pre-major status before admission to this major

Students interested in the earth sciences as a major may want to consider taking ESCI 1001 or other ESCI 1xxx course, which can be counted as an elective.

For information about University of Minnesota admission requirements, visit the Office of Admissions website.

Required prerequisites

Mathematics

Calculus I

MATH 1371 - CSE Calculus I [MATH] (4.0 cr)
or MATH 1271 - Calculus I [MATH] (4.0 cr)
or MATH 1571H - Honors Calculus I [MATH] (4.0 cr)

Calculus II

MATH 1372 - CSE Calculus II (4.0 cr)
or MATH 1272 - Calculus II (4.0 cr)
or MATH 1572H - Honors Calculus II (4.0 cr)

Chemistry

Chemistry I Lecture and Lab

Chemistry I

CHEM 1061 - Chemical Principles I [PHYS] (3.0 cr)
CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
or **Chemistry I Honors**
CHEM 1071H - Honors Chemistry I [PHYS] (3.0 cr)
CHEM 1075H - Honors Chemistry I Laboratory [PHYS] (1.0 cr)

Chemistry II Lecture and Lab

Chemistry II

CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr)
CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
or **Chemistry II Honors**
CHEM 1072H - Honors Chemistry II [PHYS] (3.0 cr)
CHEM 1076H - Honors Chemistry II Laboratory [PHYS] (1.0 cr)

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Physics
Physics I
Physics I
PHYS 1301W - Introductory Physics for Science and Engineering I [PHYS, WI] (4.0 cr)
or PHYS 1401V - Honors Physics I [PHYS, WI] (4.0 cr)
Physics II
PHYS 1302W - Introductory Physics for Science and Engineering II [PHYS, WI] (4.0 cr)
or PHYS 1402V - Honors Physics II [PHYS, WI] (4.0 cr)

Earth Sciences
ESCI 2201 - Solid Earth Dynamics (4.0 cr)
ESCI 2301 - Mineralogy (3.0 cr)

General Requirements

All students are required to complete general University and college requirements including writing and liberal education courses. For more information about University-wide requirements, see the liberal education requirements.Required courses for the major or minor in which a student receives a D grade (with or without plus or minus) do not count toward the major or minor (including transfer courses).

Program Requirements

All freshmen in the College of Science and Engineering must complete CSE 1001: First-Year Experience.
At least 22 upper division credits in the major must be taken at the University of Minnesota Twin Cities campus.

Mathematics
MATH 2373 - CSE Linear Algebra and Differential Equations (4.0 cr)
or MATH 2243 - Linear Algebra and Differential Equations (4.0 cr)
or MATH 2573H - Honors Calculus III (4.0 cr)
or MATH 2263 - Multivariable Calculus (4.0 cr)
or MATH 2374 - CSE Multivariable Calculus and Vector Analysis (4.0 cr)
or MATH 2574H - Honors Calculus IV (4.0 cr)

Major Courses
Major core courses required for all focus groups.
ESCI 2202 - Earth History (4.0 cr)
ESCI 2203 - Earth Surface Dynamics (4.0 cr)
ESCI 3202 - Fluid Earth Dynamics (4.0 cr)
ESCI 3303W - Geochemical Principles [WI] (4.0 cr)
ESCI 3891 - Field Methods (2.0 cr)

Fieldwork
Take introductory field geology (ESCI 3911) and choose one advanced field course from advanced field geology (ESCI 4911) or field hydrogeology (ESCI 4971W).
ESCI 3911 - Introductory Field Geology (4.0 cr)
ESCI 4911 - Advanced Field Geology (4.0 cr)
or ESCI 4971W - Field Hydrogeology [WI] (4.0 cr)

Technical Electives
Take 7 credits of additional elective courses in physical and natural sciences or mathematics. Students should choose elective courses in consultation with the ESci director of undergraduate studies. Though not an exhaustive list, students frequently select courses listed below to fulfill this require.
Take 7 or more credit(s) from the following:
•AST 1001 - Exploring the Universe [PHYS, ENV] (4.0 cr)
•AST 2001 - Fundamental Astrophysics (4.0 cr)
•CHEM 2301 - Organic Chemistry I (3.0 cr)
•CHEM 2302 - Organic Chemistry II (3.0 cr)
•CHEM 2311 - Organic Lab (4.0 cr)
•CSCI 1113 - Introduction to C/C++ Programming for Scientists and Engineers (4.0 cr)
•FNRM 3131 - Geographical Information Systems (GIS) for Natural Resources [TS] (4.0 cr)
•GCC 3004 *{Inactive}*[ENV] (3.0 cr)
•GCC 5008 - Policy and Science of Global Environmental Change [ENV] (3.0 cr)
•MATH 2374 - CSE Multivariable Calculus and Vector Analysis (4.0 cr)
•SOIL 2125 - Basic Soil Science [PHYS, ENV] (4.0 cr)

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•PHYS 2303 - Physics III: Physics of Matter (4.0 cr)
or PHYS 2503 - Physics III: Intro to Waves, Optics, and Special Relativity (4.0 cr)

Upper Division Requirements
25 additional upper division ESci credits, including ESci 2302, are required to complete the major. The six focus groups below are suggested courses that students may consider taking if they are interested in a particular sub-disciple of Earth and Environmental Sciences. These are only suggestions, and students may pick and choose courses from different focus groups as their interests evolve.

Upper Division Writing Intensive within the major
Students are required to take one upper division writing intensive course within the major. If that requirement has not been satisfied within the core major requirements, students must choose one course from the following list. Some of these courses may also fulfill other major requirements.
Take 0 - 1 course(s) from the following:
•ESCI 3303W - Geochemical Principles [WI] (4.0 cr)
•ESCI 4102W - Vertebrate Paleontology: Evolutionary History and Fossil Records of Vertebrates [WI] (3.0 cr)
•ESCI 4103W - Fossil Record of Mammals [WI] (3.0 cr)
•ESCI 4971W - Field Hydrogeology [WI] (4.0 cr)

Earth Sciences Focus Groups

Geology
ESCI 2302 - Petrology (3.0 cr)
ESCI 4501 - Structural Geology (3.0 cr)
ESCI 4602 - Sedimentology and Stratigraphy (3.0 cr)
ESCI 4702 - General Hydrogeology (4.0 cr)
ESCI 4701 - Geomorphology (4.0 cr)
or ESCI 4703 - Glacial Geology (4.0 cr)
9-10 additional ESCI credits with at least 7 credits at 4xxx or 5xxx levels.

-OR-

Geophysics
ESCI 2302 - Petrology (3.0 cr)
ESCI 4211 *{Inactive}*(3.0 cr)
ESCI 4501 - Structural Geology (3.0 cr)
MATH 2374 - CSE Multivariable Calculus and Vector Analysis (4.0 cr)
PHYS 2303 - Physics III: Physics of Matter (4.0 cr)
or PHYS 2503 - Physics III: Intro to Waves, Optics, and Special Relativity (4.0 cr)
Choice of two from
Take 2 or more course(s) from the following:
•ESCI 4203 - Environmental Geophysics (3.0 cr)
•ESCI 4204 - Geomagnetism and Paleomagnetism (3.0 cr)
•ESCI 4212 - Geodynamics (3.0 cr)
•ESCI 5203 - Mineral and Rock Physics (3.0 cr)
Take 3 or more credit(s) from the following:
•ESCI 4xxx
•ESCI 5xxx

-OR-

Biogeoscience
ESCI 4602 - Sedimentology and Stratigraphy (3.0 cr)
ESCI 4801 - Geomicrobiology (3.0 cr)
ESCI 5302 - Isotope Geology (3.0 cr)
ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
or ESCI 4402 - Biogeochemical Cycles in the Ocean (3.0 cr)
14 additional ESCI credits at least 9 at 4xxx or 5xxx

-OR-

Hydrogeology
ESCI 4602 - Sedimentology and Stratigraphy (3.0 cr)
ESCI 4702 - General Hydrogeology (4.0 cr)
ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
or ESCI 4701 - Geomorphology (4.0 cr)
or ESCI 4703 - Glacial Geology (4.0 cr)
15-16 additional ESCI credits with at least 9 credits at 4xxx or 5xxx.

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-OR-

Geochemistry

ESCI 2302 - Petrology (3.0 cr)
ESCI 4501 - Structural Geology (3.0 cr)
ESCI 4801 - Geomicrobiology (3.0 cr)
ESCI 5302 - Isotope Geology (3.0 cr)
ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
or ESCI 4402 - Biogeochemical Cycles in the Ocean (3.0 cr)
11 additional ESCI credits with at least 9 credits at 4xxx or 5xxx.

-OR-

Environmental Geology

ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
ESCI 4402 - Biogeochemical Cycles in the Ocean (3.0 cr)
ESCI 4702 - General Hydrogeology (4.0 cr)
ESCI 4703 - Glacial Geology (4.0 cr)
or ESCI 4801 - Geomicrobiology (3.0 cr)
12-13 additional ESCI credits with at least 9 credits at 4xxx or 5xxx.

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