Twin Cities Campus

Earth Sciences M.S.

Department of Earth Sciences

College of Science and Engineering

Link to a list of faculty for this program.

Contact Information:
Department of Earth Sciences, University of Minnesota, 310 Pillsbury Drive SE, Minneapolis, MN 55455 (612-624-1333; fax: 612-625-3819)
Email: esci@umn.edu
Website: http://www.esci.umn.edu/programs/graduate

- Program Type: Master's
- Requirements for this program are current for Spring 2018
- Length of program in credits: 30
- This program does not require summer semesters for timely completion.
- Degree: Master of Science

Along with the program-specific requirements listed below, please read the General Information section of the catalog website for requirements that apply to all major fields.

The modern earth sciences are a remarkable synthesis of the physical and biological sciences. They are at the forefront of inquiry into and solutions of most of the major issues involving the global environment: climate, oceans, freshwater in all its forms, natural resources, and natural disasters. Like no other field, they integrate all the systems, from surface to great depth, from physics to chemistry to biology, and over all of geologic time and all geographic scales. The program includes the fields of structural geology, tectonics, petrology, hydrogeology, geomorphology, sedimentology, surface processes, geochemistry, biogeochemistry, biogeology, chemical oceanography, mineralogy, mineral and rock magnetism, rock and mineral physics, geodynamics, seismology, geostatistics, planetary geology, and geophysics and applied geophysics.

Students may accommodate other areas of interest such as engineering geology, environmental geology, materials science, soil science, and paleoecology by choosing a minor or supporting field from outside the program.

Program Delivery

This program is available:

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

Prerequisites for Admission

The preferred undergraduate GPA for admittance to the program is 3.00.

A bachelor's degree in geology, geophysics, earth and material sciences, chemistry, physics, biology, or environmental science.

Other requirements to be completed before admission:
At least one year each of study in calculus, chemistry, and physics is required. In general, an outstanding academic record is expected.

Special Application Requirements:
Materials required for a complete application file include the student's statement of purpose, three letters of recommendation, transcripts, official GRE scores, and the Application for Admission. Applications are considered at any time; however, to be considered for financial aid, all materials must be submitted by January 8. Studies may begin in any semester or summer session, although fall semester is preferable. IMPORTANT: Refer to the Graduate Programs section of the department website (http://www.esci.umn.edu/programs/gradprospective) for a listing of all required application materials and preferred method of submission.

Applicants must submit their test score(s) from the following:

- GRE

International applicants must submit score(s) from one of the following tests:

- TOEFL
  - Internet Based - Total Score: 79

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- Internet Based - Writing Score: 21
- Internet Based - Reading Score: 19
- Paper Based - Total Score: 550

• IELTS
- Total Score: 6.5

• MELAB
- Final score: 80

Key to test abbreviations(GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

Plan A: Plan A requires 14 major credits, 6 credits outside the major, and 10 thesis credits.The final exam is oral.

Plan B: Plan B requires 14 to 22 major credits and 8 to 16 credits outside the major.The final exam is written and oral. A capstone project is required.
Capstone Project: Students must demonstrate familiarity with the tools of research or scholarship in their track, the ability to work independently, and the ability to present the results of their investigation effectively, by completing one or more projects, which may take the form of a research paper, presentation of research results, or completion of a faculty-supervised research experience. The Plan B project(s) should involve a minimum combined total of approximately 120 hours (the equivalent of three full-time weeks) of work.

Plan C: Plan C requires 14 to 21 major credits and 9 to 16 credits outside the major.The is no final exam.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 2.80 is required for students to remain in good standing.

At the onset of studies, a coursework "compact" will be developed with the student, his/her advisor, and the graduate studies committee. The compact will be reviewed annually to assure timely progress and revise as needed.

The masters degree is offered under Plan A (thesis), Plan B (project), or Plan C (coursework). Plan A and Plan B students must choose one of five tracks in the earth sciences program: geology, geophysics, biogeology, hydrogeology, or earth sciences. Plan C students may only choose the hydrogeology track. Tracks carry coursework requirements that are part of the student's course compact.

A maximum of 9 credits of 4xxx-level coursework may be used towards programs requirements.

Required Courses
All students must complete ESCI 8001, preferably in the first year.
ESCI 8001 - Introductory Graduate Seminar (2.0 cr)

Plan A
Plan A requires 14 credits in the major (including the track requirements); 6 credits in a minor or in related fields outside ESCI, and 10 thesis credits.
ESCI 8777 - Thesis Credits: Master's (1.0 - 18.0 cr)

Plan B
Plan B requires 14 credits in the major (including the track requirements) and 8 credits outside ESCI, which can include a minor. The remaining 8 credits can be taken in the major or in any supporting field. Up to 3 credits of ESCI 8994 may be used for the project requirement.
ESCI 8994 - Research in Earth Sciences (1.0 - 4.0 cr)

Plan C
Plan C requires 14 credits in the major (including the track requirements) and 9 credits outside ESCI, which can include a minor. The remaining 7 credits can be taken in the major or in any supporting field. Plan C students may only choose the Hydrogeology track.

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Program Sub-plans

Students are required to complete one of the following sub-plans.
Students may not complete the program with more than one sub-plan.

Biogeology

This sub-plan is limited to students completing the program under Plan A or Plan B.

Biogeology represents a rapidly growing area at the intersection between Earth and the life sciences. It includes research in microbial evolution and biochemistry, microbe/mineral chemical interactions, the role of organisms in basic geological processes, the principles through which organisms or organic compounds can be used to reconstruct surface conditions, biogeochemical cycling, pollution control and remediation, the origin of life on Earth, and astrobiology. This is a broad field that is moving in new and exciting directions, and witnessing explosive growth in understanding the variety of ways biology mediates geology and vice versa. Many of the most basic earth surface processes are now seen as intimately biological with rates and pathways dictated by organic processes. Understanding the importance of these processes, quantifying them through time and place, and learning to utilize and/or control them will be major components of earth sciences research in the 21st century.

Required Courses

Take 6 or more credit(s) from the following:

- ESCI 8402 - Biogeochemical Cycles in the Ocean (3.0 cr)
- ESCI 8801 *{Inactive}*(3.0 cr)

Earth Sciences

This sub-plan is limited to students completing the program under Plan A or Plan B.

This generalist track exists for students whose curriculum and/or thesis (paper or project for MS Plan B) do not fit any of the other four tracks. Because it is not specific to a discipline, there are no mandatory courses in the major apart from the introductory graduate seminar, a minimum of 6 additional graduate-level credits in the major program, 12 supporting program credits or completion of all requirements for a minor, and thesis credits. A curriculum specific to the student will be set through the compact process.

6-credit minimum; courses determined on an individual basis.

Geology

This sub-plan is limited to students completing the program under Plan A or Plan B.

Geology uses field observation, laboratory work, analog and computer modeling, chemical and biological probes and assays to understand Earth's coupled rock, water and biological systems, the underlying processes, and their history of interaction as evidenced in the rock record.

Required Courses

Take 6 or more credit(s) from the following:

- ESCI 5302 - Isotope Geology (3.0 cr)
- ESCI 5351 *{Inactive}*(3.0 cr)
- ESCI 5353 - Electron Microprobe Theory and Practice (3.0 cr)
- ESCI 5502 *{Inactive}*(3.0 cr)
- ESCI 5503 - Advanced Petrology (3.0 cr)
- ESCI 5601W *{Inactive}*[WI] (4.0 cr)
- ESCI 5705 - Limnogeology and Paleoenvironment (3.0 cr)

Geophysics

This sub-plan is limited to students completing the program under Plan A or Plan B.

Geophysics uses remote sensing probes (seismic waves, potential fields, etc.), laboratory simulation of deep earth conditions and computer modeling of fluid and continuum mechanical dynamics to investigate the structure, composition, history and dynamics of solid Earth and other planets.

Required Courses

ESCI 4211 *{Inactive}*(3.0 cr)

Take 1 or more course(s) totaling 3 or more credit(s) from the following:

- ESCI 4212 - Geodynamics (3.0 cr)
- ESCI 5201 - Time-Series Analysis of Geological Phenomena (3.0 cr)
- ESCI 5203 - Mineral and Rock Physics (3.0 cr)

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- ESCI 5204 - Geostatistics and Inverse Theory (3.0 cr)
- ESCI 8203 - Environmental Geophysics (3.0 cr)
- ESCI 8204 - Geomagnetism and Paleomagnetism (3.0 cr)

Hydrogeology

Hydrogeology uses direct observation and remote sensing, computer modeling and laboratory simulation to constrain the interaction of water and rock in Earth's shallow subsurface. Freshwater is Earth's most precious and increasingly overexploited resource. Hydrogeology is a key discipline in the effective shepherding of this important reserve. This track establishes a baseline curriculum for hydrogeology at the graduate level. The compact process will identify additional coursework appropriate to the student's prior training and research directions.

Required Courses

ESCI 4702 - General Hydrogeology (4.0 cr)

Take 1 or more course(s) totaling 3 or more credit(s) from the following:

- ESCI 5205 *{Inactive}*(3.0 cr)
- ESCI 5713 *{Inactive}*(3.0 cr)
- ESCI 5971 - Field Hydrogeology (2.0 cr)

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