

# EARTH SCIENCES MAJOR (B.S.)

<https://ceps.unh.edu/earth-sciences/program/bs/earth-sciences-major>

## Description

The bachelor of science in Earth sciences is offered through the Department of Earth Sciences. The program represents a strong concentration in the Earth sciences, built upon a solid formation in mathematics, physics and chemistry. The B.S. degree is especially well-suited for students who wish a strong foundation for secondary teaching or plan to continue their studies in graduate school. Beyond a central core of courses, there are several possible specializations (climate, geology, geophysics, oceanography) from which students must choose in order to develop depth in a particular area of Earth sciences. Students are encouraged to participate in research, field or internship experiences to round out their experiences in the degree program.

## Requirements

Code	Title	Credits
<b>Requirements</b>		
Satisfy the Discovery Program requirements and the bachelor of science degree requirements		
MATH 425	Calculus I <sup>1</sup>	4
MATH 426	Calculus II	4
CHEM 403	General Chemistry I <sup>1,2</sup>	4
CHEM 404	General Chemistry II <sup>1,2</sup>	4
PHYS 407	General Physics I <sup>1</sup>	4
PHYS 408	General Physics II <sup>1</sup>	4
<b>Core Curriculum</b>		
ESCI 401 or ESCI 409	Dynamic Earth Geology and the Environment	4
ESCI 402	Earth History	4
ESCI 501	Introduction to Oceanography	4
ESCI 512	Principles of Mineralogy	4
ESCI 530 or ESCI 534	Geological Field Methods <sup>3</sup> Techniques in Environmental Sciences	4
Select one of the following:		
ESCI 654	Fate and Transport in the Environment	4
ESCI 701	Quantitative Methods in Earth Sciences <sup>4</sup>	4
<b>Specializations</b>		
Select one of the following approved specializations:		
Climate		
Geology		
Geophysics		
Oceanography		
<b>Science/Math Electives</b>		
Complete three additional approved science/math electives <sup>5</sup>		
<b>Capstone</b>		
Complete the capstone requirement		
<b>Total Credits</b>		<b>48</b>

<sup>1</sup> Some of these courses may also satisfy Discovery Program requirements.

<sup>2</sup> Or CHEM 405 Chemical Principles for Engineers if applicable

<sup>3</sup> ESCI 530 Geological Field Methods is required for the geology and geophysics specializations

<sup>4</sup> Geophysics track must select ESCI 701 Quantitative Methods in Earth Sciences

<sup>5</sup> The following should be considered: additional 700-level Earth sciences courses; additional chemistry, mathematics, and physics courses; courses in computer science, engineering, and the biological sciences; and an off-campus field camp.

## Specializations

### Climate

Code	Title	Credits
ESCI 514	Introduction to Climate	3
ESCI 561	Landscape Evolution	4
Select at least two of the following:		6-7
ESCI 758	Introductory Physical Oceanography	
ESCI 760	Paleoceanography	
ESCI 762	Glacial Geology	
ESCI 765	Paleoclimatology	
Select three advanced-level approved electives		9-12
<b>Total Credits</b>		<b>22-26</b>

### Geology

Code	Title	Credits
ESCI 561	Landscape Evolution	4
ESCI 614	Introduction to Petrology	4
ESCI 631	Structural Geology	4
ESCI #652	Paleontology	4
Two approved 700-level electives		6-8
<b>Total Credits</b>		<b>22-24</b>

### Geophysics

Code	Title	Credits
MATH 527	Differential Equations with Linear Algebra	4
MATH 528	Multidimensional Calculus	4
ESCI 561	Landscape Evolution	4
or ESCI 614	Introduction to Petrology	
ESCI 631	Structural Geology	4
Select at least two of the following:		8
ESCI #734	Geophysics	
ESCI 756	Geotectonics	
ESCI 759	Geological Oceanography	
One approved 700-level elective		3-4
<b>Total Credits</b>		<b>27-28</b>

### Oceanography

Code	Title	Credits
BIOL 411	Introductory Biology: Molecular and Cellular	4
ESCI 514	Introduction to Climate	3
Select at least three of the following:		10-11
ESCI 752	Chemical Oceanography	
ESCI 758	Introductory Physical Oceanography	
ESCI 759	Geological Oceanography	
MEFB 755	Biological Oceanography	
Complete three advanced-level approved electives		9-12
<b>Total Credits</b>		<b>26-30</b>

## Capstone Experience

A capstone experience is required of all undergraduate Earth sciences majors during their senior year. All capstone experiences at UNH must meet one or more of the following criteria:

1. The capstone synthesizes and applies disciplinary knowledge and skills.
2. The capstone fosters reflection on undergraduate learning and experience.
3. The capstone demonstrates emerging professional competencies.

- The capstone applies, analyzes, and/or interprets research or data or artistic expression.
- The capstone explores areas of interest based on the integration of prior learning.

Suggested ways of meeting the capstone requirement in the Department of Earth Sciences include approved INCO 790 Advanced Research Experience, ESCI 795 Topics/ESCI 796 Topics, ESCI 799 Senior Thesis, URA/SURF/IROP projects, internships, environmental/geologic field camps, REU programs, or Earth Sciences education and outreach activities designed according to the above criteria. Capstone experiences must be equivalent to a minimum of 2 academic credits. Students should work closely with their faculty advisors to define the most appropriate capstone experience for their Earth Sciences degree program, although the capstone mentor can be someone other than their primary faculty advisor. All capstone experiences must be approved and certified by the faculty advisor and the capstone mentor. Presentation of projects or experiences developed for the capstone is encouraged at the annual UNH Undergraduate Research Conference or other appropriate venue.

## Degree Plan

### Climate Track

Course	Title	Credits
<b>First Year</b>		
<b>Fall</b>		
ESCI 400	Freshman Field Seminar	1
ESCI 401	Dynamic Earth	4
MATH 425	Calculus I	4
CHEM 403	General Chemistry I	4
ENGL 401	First-Year Writing (or pass placement test)	4
<b>Credits</b>		<b>17</b>
<b>Spring</b>		
ESCI 402	Earth History	4
MATH 426	Calculus II	4
CHEM 404	General Chemistry II	4
Inquiry Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>16</b>
<b>Second Year</b>		
<b>Fall</b>		
ESCI 501	Introduction to Oceanography	4
ESCI 530 or ESCI 534	Geological Field Methods or Techniques in Environmental Sciences	4
PHYS 407	General Physics I	4
Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>16</b>
<b>Spring</b>		
ESCI 512	Principles of Mineralogy	4
ESCI 514	Introduction to Climate	3
PHYS 408	General Physics II	4
Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>15</b>

### Third Year

#### Fall

ESCI 561	Landscape Evolution	4
ESCI 758 or ESCI 760	Introductory Physical Oceanography (or 6/7_) or Paleoceanography	3
ESCI ___ or Free Elective		4
Discovery Course <sup>1</sup>		4
Seminar or Research Experience		1
<b>Credits</b>		<b>16</b>

#### Spring

ESCI 654 or ESCI 701	Fate and Transport in the Environment or Quantitative Methods in Earth Sciences	4
ESCI 762 or ESCI 765	Glacial Geology (or 6/7_) or Paleoclimatology	4
Science Elective <sup>2</sup>		4
Discovery course		4
<b>Credits</b>		<b>16</b>

### Fourth Year

#### Fall

ESCI 6/7_		4
ESCI 758 or ESCI 760	Introductory Physical Oceanography (or 6/7_) or Paleoceanography	3
Science Elective <sup>2</sup>		4
Discovery Course <sup>1</sup>		4
Seminar or Research Experience		1
<b>Credits</b>		<b>16</b>

#### Spring

ESCI 762 or ESCI 765	Glacial Geology (or 6/7_) or Paleoclimatology	4
Science Elective <sup>2</sup>		4
Discovery Course <sup>1</sup>		4
Senior Capstone		4
<b>Credits</b>		<b>16</b>
<b>Total Credits</b>		<b>128</b>

### Geology Track

Course	Title	Credits
<b>First Year</b>		
<b>Fall</b>		
ESCI 400	Freshman Field Seminar	1
ESCI 401	Dynamic Earth	4
MATH 425	Calculus I	4
CHEM 403	General Chemistry I	4
ENGL 401	First-Year Writing (or pass placement test)	4
<b>Credits</b>		<b>17</b>
<b>Spring</b>		
ESCI 402	Earth History	4
MATH 426	Calculus II	4
CHEM 404	General Chemistry II	4

Inquiry Discovery Course <sup>1</sup>	4
<b>Credits</b>	<b>16</b>
<b>Second Year</b>	
<b>Fall</b>	
ESCI 530 Geological Field Methods	4
ESCI 561 Landscape Evolution	4
PHYS 407 General Physics I	4
Discovery Course <sup>1</sup>	4
<b>Credits</b>	<b>16</b>
<b>Spring</b>	
ESCI 501 Introduction to Oceanography	4
ESCI 512 Principles of Mineralogy	4
PHYS 408 General Physics II	4
Discovery Course <sup>1</sup>	4
<b>Credits</b>	<b>16</b>
<b>Third Year</b>	
<b>Fall</b>	
ESCI 614 Introduction to Petrology	4
ESCI 631 Structural Geology	4
ESCI #652 Paleontology	4
Discovery Course <sup>1</sup>	4
<b>Credits</b>	<b>16</b>
<b>Spring</b>	
ESCI 654 Fate and Transport in the Environment (or or ESCI 701 6_)	4
	or Quantitative Methods in Earth Sciences
Free Elective	4
Science Elective <sup>2</sup>	4
Discovery Course <sup>1</sup>	4
<b>Credits</b>	<b>16</b>
<b>Fourth Year</b>	
<b>Fall</b>	
ESCI 7__	4
Free Elective	4
Science Elective <sup>2</sup>	4
Discovery Course <sup>1</sup>	4
<b>Credits</b>	<b>16</b>
<b>Spring</b>	
ESCI 7__	4
Science Elective <sup>2</sup>	4
Discovery Course <sup>1</sup>	4
Senior Capstone	4
<b>Credits</b>	<b>16</b>
<b>Total Credits</b>	<b>129</b>

## Geophysics Track

Course	Title	Credits
<b>First Year</b>		
<b>Fall</b>		
ESCI 400	Freshman Field Seminar	1
ESCI 401	Dynamic Earth	4

MATH 425	Calculus I	4
CHEM 403	General Chemistry I	4
ENGL 401	First-Year Writing (or pass placement test)	4
<b>Credits</b>		<b>17</b>
<b>Spring</b>		
ESCI 402	Earth History	4
MATH 426	Calculus II	4
CHEM 404	General Chemistry II	4
Inquiry Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>16</b>
<b>Second Year</b>		
<b>Fall</b>		
ESCI 530	Geological Field Methods	4
ESCI 561	Landscape Evolution (or 6/7_)	4
PHYS 407	General Physics I	4
Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>16</b>
<b>Spring</b>		
ESCI 501	Introduction to Oceanography	4
ESCI 512	Principles of Mineralogy	4
PHYS 408	General Physics II	4
Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>16</b>
<b>Third Year</b>		
<b>Fall</b>		
ESCI 614	Introduction to Petrology (or 6/7_)	4
ESCI 631	Structural Geology	4
MATH 527	Differential Equations with Linear Algebra	4
Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>16</b>
<b>Spring</b>		
ESCI 701	Quantitative Methods in Earth Sciences	4
MATH 528	Multidimensional Calculus	4
Science Elective <sup>2</sup>		4
Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>16</b>
<b>Fourth Year</b>		
<b>Fall</b>		
ESCI 759	Geological Oceanography	4
Free Elective		4
Science Elective <sup>2</sup>		4
Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>16</b>
<b>Spring</b>		
ESCI #734	Geophysics (or ESCI 756)	4
Science Elective <sup>2</sup>		4
Discovery Course <sup>1</sup>		4
Senior Captstone		4
<b>Credits</b>		<b>16</b>
<b>Total Credits</b>		<b>129</b>

## Oceanography Track

Course	Title	Credits
<b>First Year</b>		
<b>Fall</b>		
ESCI 400	Freshman Field Seminar	1
ESCI 401	Dynamic Earth	4
MATH 425	Calculus I	4
CHEM 403	General Chemistry I	4
ENGL 401	First-Year Writing (or pass placement test)	4
<b>Credits</b>		<b>17</b>
<b>Spring</b>		
ESCI 402	Earth History	4
MATH 426	Calculus II	4
CHEM 404	General Chemistry II	4
Inquiry Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>16</b>
<b>Second Year</b>		
<b>Fall</b>		
ESCI 501	Introduction to Oceanography	4
ESCI 530 or ESCI 534	Geological Field Methods or Techniques in Environmental Sciences	4
PHYS 407	General Physics I	4
Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>16</b>
<b>Spring</b>		
ESCI 512	Principles of Mineralogy	4
ESCI 514	Introduction to Climate	3
PHYS 408	General Physics II	4
Discovery Course <sup>1</sup>		4
<b>Credits</b>		<b>15</b>
<b>Third Year</b>		
<b>Fall</b>		
ESCI 758	Introductory Physical Oceanography (or 6/7__)	3
ESCI 6/7__ or Free Elective		4
Science Elective <sup>2</sup>		4
Discovery Course <sup>1</sup>		4
Seminar or Research Experience		1
<b>Credits</b>		<b>16</b>
<b>Spring</b>		
ESCI 654 or ESCI 710	Fate and Transport in the Environment (or 6/7__) or Groundwater Hydrology	4
ESCI 6/7__ or Free Elective		4
MEFB 755	Biological Oceanography	4
Discovery Course		4
<b>Credits</b>		<b>16</b>
<b>Fourth Year</b>		
<b>Fall</b>		
ESCI 6/7__		4
ESCI 759	Geological Oceanography (or 6/7__)	4

Science Elective <sup>2</sup>	4
Discovery Course <sup>1</sup>	4
<b>Credits</b>	
<b>16</b>	
<b>Spring</b>	
ESCI 752	Chemical Oceanography (or 6/7__)
3	
Science Elective <sup>2</sup>	4
Discovery Course <sup>1</sup>	4
Senior Capstone	4
Seminar or Research Experience	1.0
<b>Credits</b>	
<b>16</b>	
<b>Total Credits</b>	
<b>128</b>	

<sup>1</sup> One course must be taken in each of the remaining Disciplinary Groups of the University Discovery Program (Biological Sciences; Environment Technology & Society; Historical Perspectives; World Culture; Fine & Performing Arts; Social Science; Humanities).

<sup>2</sup> Three science electives must be approved in consultation with departmental advisor.

## Student Learning Outcomes

- Recognize common Earth materials and structures.
- Describe how Earth scientists construct the geological time scale and apply age dating techniques.
- Describe the broad attributes of and interactions within the Earth System, as well as its geological history, how and why it is changing today, and how those changes impact society.
- Understanding Earth processes and cycles.
- Recognize common Earth materials and structures.
- Perform simple calculations to evaluate and manipulate quantitative geologic data.
- Interpret a geologic map and cross section in terms of the sequence of geologic events and understand the processes that caused those events.
- Collect, interpret, and synthesize basic field observations and measurements to develop and test multiple working hypotheses to explain them.
- Become proficient in basic geological laboratory skills (including microscopes and x-ray diffraction).
- Summarize, analyze, and evaluate their own scientific data and the primary Earth Sciences literature.
- Effectively communicate results of scientific inquiries orally, visually, and in writing.