

Earth and Space Sciences (ESS)

Interdisciplinary Major in

Earth and Space Sciences

Department of Geosciences, College of Arts and Sciences

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Minors of particular interest to students majoring in Geology and Earth and Space Sciences: Environmental Studies (ENS), Marine Sciences (MAR), Engineering minors

Faculty

Please see the faculty listing in the entry for the Geology major.

Earth and Space Sciences is a broadly based multidisciplinary field combining geology, astronomy, atmospheric science, and marine science. The major in Earth and Space Sciences is a diversified program in the natural sciences and mathematics aimed at fostering a basic understanding of the earth and space sciences; it also includes concentrated study in any one of the natural sciences or mathematics or interdisciplinary studies in environmental geoscience. Intended for those seeking a science-related career, the program is flexible in that it is designed to meet the needs of students who desire a more diverse liberal arts and sciences background. The various programs prepare students to choose careers in teaching, law, environmental science, secondary education, or research in private industry and government.

Requirements for the Major in Earth and Space Sciences (ESS)

The major in Earth and Space Sciences leads to the Bachelor of Arts degree. All courses offered for the major must be passed with a letter grade of C or higher.

Completion of the major requires approximately 61-72 credits.

Requirements for the Earth and Space Sciences Track

A. Introductory earth and space sciences courses

GEO 103 The Earth Through Time and GEO 113 Historical Geology Laboratory

GEO 122 Physical Geology or GEO 102 The Earth and GEO 112 Physical Geology Laboratory

AST 101 Introduction to Astronomy

AST 112 Astronomy Laboratory

ATM 205 Introduction to Atmospheric Sciences

B. Upper-division earth and space sciences courses

At least four upper-division GEO, AST, ATM courses; at least one must include a laboratory

C. Introductory related science courses

1. MAT 131, 132 Calculus I, II (See Notes 1 and 2 below)
2. PHY 121 Physics for Life Sciences or PHY 125 Classical Physics A or PHY 131/133 Classical Physics I and lab or PHY 141 Classical Physics I: Honors
3. Any two of the following groups (See Notes 3, 4, and 5 below):
 - a. PHY 122/124 Physics for Life Sciences or PHY 132/134 Classical Physics II and lab or PHY 142 Classical Physics II: Honors or PHY 126, 127 Classical Physics B and C
 - b. CHE 131, 132 General Chemistry I, II or CHE 141, 142 Honors Chemistry I, II (See Note 3)
 - c. BIO 150 The Living World and BIO 201 Fundamentals of Biology: Organisms to Ecosystems

D. Specific science concentration

At least 12 credits in courses acceptable for one of the following concentrations: astronomy, atmospheric sciences, biology, chemistry, geology, environmental geoscience, marine sciences, mathematics, or physics. Students must obtain departmental approval of courses chosen to satisfy the specific science concentration.

E. Upper-division writing requirement

All students in the Earth and Space Sciences track must submit two papers (term papers, laboratory reports, or independent research papers) to the director of undergraduate studies for departmental evaluation by the end of the junior year.

If this evaluation is satisfactory, the student will have fulfilled the upper-division writing requirement. If it is not, the student must fulfill the requirement before graduation.

Notes:

1. The following alternate beginning calculus sequences may be substituted for MAT 131, 132 in major requirements or prerequisites: MAT 125, 126, 127 or 141, 142, or MAT 171, or AMS 151, 161. Equivalency for MAT courses achieved by earning the appropriate score on a University mathematics placement examination will be accepted as fulfillment of the requirement without the necessity of substituting other credits.
2. For biology, chemistry, geology, and marine sciences concentrations, MAT 132 or 127 may be waived under compelling circumstances and with the written permission of the ESS advisor.
3. For the concentration in chemistry, the sequence CHE 123, 124, 132 or CHE 129, 132 may be used to satisfy requirement C3.
4. For astronomy, atmospheric sciences, mathematics, and physics concentrations, PHY 121/123 and 122/124 are not acceptable under Requirements C2 and C3.
5. For the concentration in physics, MAT 205, 203, or AMS 261 and MAT 305, 303, or AMS 361 are required, and two semesters under Requirement C3 may be waived.

Sample Course Sequence for the Major in Earth and Space Sciences

Freshman Fall	Credits
First Year Seminar 101	1
D.E.C. A	3
CHE 131	4
GEO 102	3
GEO 112	1
D.E.C. (or MAT 123 if needed)	3
Total	15

Spring	Credits
First Year Seminar 102	1
D.E.C. A	3
CHE 132	4
MAT 125 or 131	3-4
GEO 103	3
GEO 113	1
Total	15-16

Sophomore Fall	Credits
MAT 126 or 132	3-4
PHY 121/123 or 131/133	4
D.E.C.	3
D.E.C.	3
Total	13-14

Spring	Credits
PHY 122/124 or 132/134	4
GEO/AST/ATM Elective	3
D.E.C. or MAT 127	3
D.E.C.	3
Upper-Division D.E.C.	3
Total	16

Junior Fall	Credits
ATM 205	3
Upper-Division Concentration elective	3
AST 101	3
AST 112	1
BIO 150	3
Upper-Division D.E.C.	3
Total	16

Spring	Credits
Upper-Division Concentration elective	3
GEO/AST/ATM Elective	4
BIO 201	3
D.E.C.	3
Upper-Division elective	3
Total	16

Senior Fall	Credits
Upper-Division Concentration elective	3
Upper-Division GEO, AST, or ATM elective	3
D.E.C.	3
Upper-Division D.E.C.	3
Upper-Division elective or D.E.C.	3
Total	15

Spring	Credits
Upper-Division Concentration elective	3
GEO/AST/ATM Elective	3
Upper-Division D.E.C.	3
Upper-Division D.E.C.	3
Upper-Division elective	3
Total	15

the program director. At least two of the courses must include a laboratory.

C. Specific Science Concentration

At least 12 credits of the 24 elective credits must be chosen from one of the earth and space science disciplines: astronomy, atmospheric sciences or geosciences.

D. Upper-division writing requirement

All students in the earth science education track must submit two papers (term papers, laboratory reports, or independent research reports) that involve collecting data or observations, processing and interpreting this information, and preparing a professional-quality report. These reports must be submitted to the director of undergraduate studies for evaluation by the end of the junior year. If this evaluation is satisfactory, the student will have fulfilled the upper-division writing requirement. If it is not, the student must fulfill the requirement before graduation.

Note: The sequence CHE 123, 124 or CHE 129, 132 may be substituted for CHE 131, 132, with permission of the undergraduate program director.

Earth Science Secondary Teacher Education Program

See the Education and Teacher Certification entry in the alphabetical listings of Approved Majors, Minors, and Programs.

Requirements for the Earth Science Education Track

A. Introductory science courses

GEO 102 The Earth and GEO 112 Physical Geology
 GEO 103 The Earth Through Time and GEO 113 Historical Geology Laboratory
 AST 101 Introduction to Astronomy and AST 112 Astronomy Laboratory
 ATM 205 Introduction to Atmospheric Sciences
 BIO 150 The Living World

BIO 201 Fundamentals of Biology: Organisms to Ecosystems
 CHE 131, 132 General Chemistry I and II (see note below)
 CHE 133, 134 General Chemistry Laboratory I and II
 AMS 102 Elements of Statistics
 MAT 125 Calculus A
 PHY 119 Physics for Environmental Studies or PHY 125 Classical Physics A
 ATM 102 Weather and Climate

B. Elective Courses

At least 24 credits from the approved course list, chosen in consultation with