

**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

**Earth and Space Sciences (ESS)**

Earth and Space Sciences is a broadly based multidisciplinary field combining geology, astronomy, atmospheric science, and marine science administered by the Department of Geosciences (see Geology major for departmental information). 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 61-73 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, MAT 132 Calculus I, II (See Notes 1 to 3 below)
2. PHY 121/PHY 123 Physics for Life Sciences or PHY 125 Classical Physics A or PHY 131/PHY 133 Classical Physics I and lab or PHY 141 Classical Physics I: Honors
3. Any two of the following groups: a. PHY 122/PHY 124 Physics for Life Sciences (see Note 3) or PHY 132/PHY 134 Classical Physics II and labor PHY 142 Classical Physics II: Honors or PHY 126, PHY 127 Classical Physics B and C b. CHE 131 (129), CHE 132 General Chemistry I, II or CHE 141, CHE 142 Honors Chemistry I, II (See Note 3) c. BIO 201 Fundamentals of Biology: Organisms to Ecosystems and BIO 204 Fundamentals of Scientific Inquiry in the Biological Sciences I (see Note)

Note: Students who choose to take BIO 201/BIO 204 as an option are required to take CHE 131 or CHE 141 instead of a second semester of Physics.

D. Specific science concentration

At least 12 credits in courses acceptable for one of the following concentrations: astronomy, atmospheric sciences, biology, chemistry, geology, 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, MAT 132 in major requirements or prerequisites: MAT 125, MAT 126, MAT 127 or MAT 141, MAT 142, or MAT 171, or AMS 151, AMS 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 astronomy, atmospheric sciences, mathematics, and physics concentrations, PHY 121/PHY 123 and PHY 122/PHY 124 are not acceptable under Requirements C2 and C3.
3. For the concentration in physics, one of MAT 205, MAT 203, or AMS 261 and one of MAT 305, MAT 303, or AMS 361 are required.

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 201 Fundamentals of Biology: Organisms to Ecosystems
- BIO 202 Fundamentals of Biology: Molecular and Cellular Biology
- BIO 204 Fundamentals of Scientific Inquiry in the Biological Sciences I
- CHE 131, CHE 132 General Chemistry I and II (see note below)
- CHE 133, CHE 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 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, CHE 124 or CHE 129, CHE 132 may be substituted for CHE 131, CHE 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.

**Sample Course Sequence for the Major in Earth and Space Sciences**

Freshman Fall	Credits	Spring	Credits
First Year Seminar 101	1	First Year Seminar 102	1
D.E.C. A	3	D.E.C. A	3
CHE 131	4	CHE 132	4
GEO 102	3	MAT 125 or MAT 131	3-4
GEO 112	1	GEO 103	3

D.E.C. (or MAT 123 if needed)	3	GEO 113	1
Total	15	Total	15-16
<b>Sophomore Fall</b>			
<b>Credits</b>		<b>Spring</b>	<b>Credits</b>
MAT 126 or MAT 132	3-4	PHY 122/PHY 124 or PHY 132/ PHY 134	4
PHY 121/PHY 123 or PHY 131/ PHY 133	4	GEO/AST/ATM Elective	3
D.E.C.	3	D.E.C. or MAT 127	3
D.E.C.	3	D.E.C.	3
		Upper-Division D.E.C.	3
Total	13-14	Total	16
<b>Junior Fall</b>			
<b>Credits</b>		<b>Spring</b>	<b>Credits</b>
ATM 205	3	Upper-Division Concentration elective	3
Upper-Division Concentration elective	3	GEO/AST/ATM Elective	4
AST 101	3	BIO 204	2
AST 112	1	D.E.C.	3
BIO 201	3	Upper-Division elective	3
Upper-Division D.E.C.	3		
Total	16	Total	15
<b>Senior Fall</b>			
<b>Credits</b>		<b>Spring</b>	<b>Credits</b>
Upper-Division Concentration elective	3	Upper-Division Concentration elective	3
Upper-Division GEO, AST, or ATM elective	3	GEO/AST/ATM Elective	3
D.E.C.	3	Upper-Division D.E.C.	3
Upper-Division D.E.C.	3	Upper-Division D.E.C.	3
Upper-Division elective or D.E.C.	3	Upper-Division elective	3
Total	15	Total	15

No courses are associated with this academic program.