Earth Science

The Wiess School of Natural Sciences

Chair
Alan Levander

Professors
John B. Anderson
Hans G. Avé Lallemant
Richard G. Gordon
William P. Leeman
Dale S. Sawyer
Manik Talwani

Associate Professors
Gerald R. Dickens
André W. Droxler
Andreas Luttge
Colin A. Zelt

Assistant Professors
Cin-Ty Lee
Adrian Lenardic
Julia Morgan

Adjunct Professors
K. K. Bissada
Carlos A. Cramer
Stephen H. Danbom
Jeffrey J. Dravis
Robert B. Dunbar
Paul M. Harris
Garry D. Jones
M. Turhan Taner
John C. Van Wagoner
Gerard M. Wellington
James L. Wilson

Adjunct Associate Professors
James Pindell
W. C. Rusty Riese

Adjunct Assistant Professors
Vitor Abreu
Robert Herrick
Scott A. Morton
Paul D. Spudis
Gábor Tari
Yitian Xiao

Degrees Offered: B.A., B.S., M.A., Ph.D.

The undergraduate program in geology focuses on a strong core of courses in all areas of earth materials, processes, and history, as well as in allied sciences. Students also gain experience with analytical equipment, computer systems, and in fieldwork. The undergraduate geophysics major combines courses that apply physics to the study of the earth’s interior with course work in geology and mathematics. The program emphasizes computational geophysics and reflection seismology. A second major can lay the foundation for a career in environmental geology, and students may also acquire certification in courses toward science as a teaching field.

Advanced graduate work is available in marine geology and paleoceanography, stratigraphy, carbonate and siliciclastic sedimentology, igneous petrology, geochemistry, structural geology, regional tectonics, global plate tectonics, reflection and crustal seismology, and computational geophysics and geodynamics. Ideally, programs of study and research incorporate more than one of these specialties.

Degree Requirements for B.S. in Geophysics

For general university requirements, see Graduation Requirements (pages 18–20). Completing the requirements of this major as well as university graduation requirements will involve completing about 129 credit hours. Students must complete the following courses:

Earth Science
ESCI 101 The Earth
or ESCI 102 Evolution of the Earth
or ESCI 107 Oceans and Global Change
or ESCI 108 Crises of the Earth
ESCI 105 Introductory Lab for Earth Science

Math and Other Sciences
MATH 101/102 Single Variable Calculus I and II

Environmental Geology
Students interested in careers in environmental geology are encouraged to take some of the following courses as electives.

ESCI 353 Environmental Geochemistry
ESCI 326/426 Environmental Geology
ESCI 451 Analysis of Environmental Data
ESCI 454 Geographic Information Science
ENVI 306 Global Environmental Law and Sustainable Development
ENVI 401 Introduction to Environmental Chemistry
ENVI 406 Introduction to Environmental Law
ENVI 412 Hydrology and Watershed Analysis

In addition, students may consider a second major in environmental science and engineering.

Degree Requirements for B.S. in Geophysics

Completing the requirements for this major as well as university graduation requirements will involve completing about 129 credit hours. Students must complete the following courses:

Earth Science
ESCI 101 The Earth
or ESCI 102 Evolution of the Earth
or ESCI 107 Oceans and Global Change
or ESCI 108 Crises of the Earth
ESCI 105 Introductory Lab for Earth Science

Math and Other Sciences
MATH 101/102 Single Variable Calculus I and II

ENVI 401 Introduction to Environmental Chemistry
ENVI 406 Introduction to Environmental Law
ENVI 412 Hydrology and Watershed Analysis
Earth Science

ESCI 101 The Earth
or ESCI 102 Evolution of the Earth
or ESCI 107 Oceans and Global Change
or ESCI 108 Crises of the Earth
ESCI 105 Introductory Lab for Earth Science
ESCI 311 Mineralogy and Optics
or ESCI 332 Sedimentology
ESCI 334 Geological and Geophysical Techniques
ESCI 390 Field Geology
ESCI 442 Exploration Geophysics I
ESCI 444 Exploration Geophysics II
ESCI 446 Solid Earth Geophysics
ESCI 441 Geophysical Data Analysis
or ESCI 462 Tectonophysics
or ESCI 464 Global Tectonics

Math and Other Sciences

MATH 101/102 Single Variable Calculus I and II
MATH 211 Ordinary Differential Equations and Linear Algebra
MATH 212 Multivariable Calculus
CHEM 121/122 General Chemistry with Laboratory
PHYS 101 or 111 Mechanics
PHYS 102 or 112 Electricity and Magnetism
PHYS 201 Waves and Optics
PHYS 231 Elementary Physics Lab II
NSCI 230 Computation in Natural Science
or CAAM 210 Introduction to Engineering Computation (C)
or CAAM 211 Introduction to Engineering Computation (F)
or COMP 210 Introduction to Principles of Scientific Computation

Degree Requirements for B.A. in Geology

For general university requirements, see Graduation Requirements (pages 18–20). Students completing the B.A. program should have a total of at least 120 hours at graduation. Students must complete the following courses:

Earth Science

ESCI 101 The Earth
or ESCI 102 Evolution of the Earth
or ESCI 107 Oceans and Global Change
or ESCI 108 Crises of the Earth
ESCI 105 Introductory Lab for Earth Science
ESCI 311 Mineralogy and Optics
ESCI 312 Petrology
ESCI 331 Structural Geology
ESCI 332 Sedimentology
ESCI 334 Geological and Geophysical Field Techniques

Math and Other Sciences

MATH 101/102 Single Variable Calculus I and II
CHEM 121/122 or CHEM 151/152 General Chemistry I and II
6 credits from the following list

- BIOL 201/202 Introductory Biology I and II
- BIOL 211, 213 Biology Lab Modules
- MATH 211 Differential Equations
- PHYS 101/102, 125/126 Introductory Physics
- NSCI 230, CAAM 210/211, COMP 210 Programming

Required Electives. Students must also complete at least 12 hours in additional courses in Science and Engineering (including ESCI) at the 200 level or higher, from an approved list.

Undergraduate Independent Research

The department encourages, but does not require, both geology and geophysics undergraduate majors to pursue independent supervised research in ESCI 481/482 Research in Earth Science. See also Honors Programs (page 32).

Degree Requirements for M.A. and Ph.D. in Earth Science

All incoming students should have a strong background in physics, chemistry, and mathematics and should have, or should acquire, a broad grounding in fundamental earth science. The department encourages applications from well-qualified students with degrees in the other sciences and mathematics. For general university requirements, see Graduate Degrees (pages 62–67). The requirements for the M.A. and Ph.D. in earth science are similar, but the Ph.D. demands a significantly higher level of knowledge, research skills, and scholarly independence. Most students need at least two years beyond the bachelor’s degree to complete the M.A. and at least two years beyond the M.A. degree for the Ph.D.

Candidates determine, with their major professor and advisory committee, a course of study following the Guidelines for Advanced Degrees in the Department of Earth Science distributed to all incoming students. For both degrees, candidates must:

- Complete 20 semester hours of course work at the 400 level and above (or other approved courses), not including research hours
- Pass a written preliminary exam
- Maintain a grade point average of 3.00 (B) or better
- Prepare a written thesis
- Produce a publishable thesis that represents an original contribution to science
- Defend the research and conclusions of the thesis in an oral examination

Students of exceptional ability with a bachelor’s degree and department approval may work directly toward the Ph.D., in which case the course of study is equivalent to that required for both degrees; performance on the examinations and the thesis, however, should be at the level required for the Ph.D.

Because the graduate programs require full-time study and close interaction with faculty and fellow students, the department discourages students from holding full (or nearly full) time jobs outside the university. Outside employment must be approved by the chair.

See ESCI in the Courses of Instruction section.