

Geoscience, Ph.D.

COLLEGE OF SCIENCE AND TECHNOLOGY

Learn more about the Doctor of Philosophy in Geoscience.

About the Program

The Department of Earth and Environmental Science offers a Ph.D. program that includes graduate courses in the geosciences, weekly graduate seminars, qualifying exams, and research leading to a doctoral dissertation.

Time Limit for Degree Completion: 7 years

Campus Location: Main

Full-Time/Part-Time Status: Full-time status is expected.

Areas of Specialization: Advanced courses and research opportunities are available in:

- Environmental geology, including ecohydrology, energy and land degradation, environmental geophysics, groundwater modeling, ice sheet stability and climate change, Karst hydrology, nanomineralogy, and urban hydrology.
- Geochemistry, including nanomineralogy, paleontology-fossil provenance, planetary geology, and weathering and diagenesis.
- Sedimentary geology and paleontology, including coastal and aeolian dynamics, ichnology, paleontology-fossil provenance, paleopedology and modern soils, planetary geology and impact studies, and Precambrian geology.
- Structural geology, including geothermal energy and geomechanics.

Job Prospects: Graduates secure positions in academia, industry, and government.

Licensure: For careers in industry, licensure is recommended after three years of on-the-job training. The Pennsylvania Professional Geologist Licensing Examination is administered by the National Association of State Boards of Geology (ASBOG®).

Non-Matriculated Student Policy: Doctoral courses are open only to matriculated students.

Financing Opportunities: Students are supported by a combination of Teaching and Research Assistantships, which typically provide a nine-month academic-year stipend and full tuition remission. Summer stipends are also available. Teaching and Research Assistants are expected to devote 20 hours per week to their duties. Teaching Assistants teach introductory geology labs and labs for majors. The duties for Research Assistants are determined by the primary research advisor. Both Teaching and Research Assistantships are awarded competitively. Funding after four years is not guaranteed.

Temple University also offers a limited number of two-year fellowships to support outstanding doctoral students.

Admission Requirements and Deadlines

Application Deadline:

Fall: January 15

Spring: October 15

For full consideration, applications must be submitted by the deadline. Late applications may be considered on a case-by-case basis. Applicants should target Fall entry as Spring admission is rare.

Program admissions are limited and competitive. Applicants are expected to contact the faculty in their area of interest prior to submitting an application.

APPLY ONLINE to this graduate program.

Letters of Reference:

Number Required: 3

From Whom: Letters of recommendation should be obtained from college/university faculty members familiar with the applicant's academic competence.

Coursework Required for Admission Consideration: Applicants are required to have taken courses in Geology to prepare them for graduate-level classes and instructing undergraduate majors. In addition, at least one year of college-level Chemistry, Calculus, and either Physics or Biology is expected.

Master's Degree in Discipline/Related Discipline: A master's degree is recommended, but undergraduate research experience is also considered in evaluating applicants.

Bachelor's Degree in Discipline/Related Discipline: A baccalaureate degree, whether a B.A. or a B.S., with a major in Geology or a related program in Science or Mathematics is required.

Statement of Goals: Identify your specific interest in Temple's Geoscience Ph.D. program and the faculty member with whom you would like to work, and report on your research goal, future career goals, and academic and research achievements.

Standardized Test Scores:

GRE: Required. Scores above the 50th percentile in the quantitative and verbal sections are expected, but higher scores are more competitive.

Applicants who earned their baccalaureate degree from an institution where the language of instruction was other than English, with the exception of those who subsequently earned a master's degree at a U.S. institution, must report scores for a standardized test of English that meet these minimums:

- TOEFL iBT: 105
- IELTS Academic: 7.0
- PTE Academic: 72

Writing Sample: Applicants are required to submit a writing sample directly to the Graduate Chair of Earth and Environmental Science. Acceptable materials include the undergraduate thesis or research paper, master's thesis, and published journal articles in which the applicant is first author.

Program Requirements

General Program Requirements:

Number of Credits Required Beyond the Baccalaureate: 37, including 7 courses required in the Department of Earth and Environmental Science, with one additional course taken outside of the department, if desired

Number of Credits Required Beyond the Master's: 18, including 3 courses required in the Department of Earth and Environmental Science, with one additional course taken outside of the department, if desired

Required Courses:

Code	Title	Credit Hours
Core Courses		
Select courses from the following to total 28 credits: ¹		28
EES 5011	Remote Sensing and GIS	
EES 5042	Coastal Processes	
EES 5101	Structural Geology (Graduate)	
EES 5401	Analytical Methods in Mineralogy	
EES 5402	X-ray Crystallography	
EES 5406	Nanoscience and the Environment	
EES 5434	Ecohydrology	
EES 5454	Introduction to Geophysics	
EES 5461	Low-Temperature Geochemistry	
EES 5462	Advanced Low-Temperature Geochemistry	
EES 5502	Glaciology	
EES 5601	Vertebrate Paleontology and Taphonomy	
EES 5625	Electron Optical Techniques	
EES 5702	Sedimentary Petrology	
EES 5725	Soils and Paleosols	
EES 5801	Quantitative Structural Geo	
EES 5802	Tectonics	
EES 5811	Planetary Geology	
EES 8000	Geology Seminar	
EES 8200	Graduate Geology Seminar	
EES 8411	Advanced Hydrogeology	
EES 8421	Groundwater Modeling	

Elective ²		3
Research Courses		6
EES 9994	Preliminary Examination Preparation	
EES 9998	Pre-Dissertation Research / Elevation to Candidacy	
EES 9999	Dissertation Research	
<hr/>		
Total Credit Hours		37

¹ Select three of the courses if entering the Ph.D. program with a master's degree.

² The elective is selected in consultation with an advisor.

Culminating Events:

Qualifying for Ph.D. candidacy includes completion of coursework within the Department of Earth and Environmental Science, as well as demonstrations of subject area knowledge, skill, and the ability to conduct research to define and investigate new questions. The assessment for candidacy consists of four parts:

1. Completion of a minimum of three departmental graduate courses in good standing
2. Successfully passing the written and oral components of the Preliminary Examination
3. Submission and acceptance of an NSF-style research proposal
4. Oral defense of the research proposal

Dissertation:

The Department of Earth and Environmental Science requires an original research dissertation as the culminating project in its Ph.D. program.

Contacts

Program Web Address:

<https://www.temple.edu/academics/degree-programs/geoscience-phd-st-gesc-phd>

Department Information:

Dept. of Earth and Environmental Science
326 Beury Hall
1901 N. 13th Street
Philadelphia, PA 19122-6081
eesgrad@temple.edu
215-204-8227

Submission Address for Application Materials:

<https://cst.temple.edu/academics/graduate-programs/apply-now>

Department Contacts:

Administrative Assistant:

Shelah Cox
scox@temple.edu
215-204-8227

Admissions:

Dennis O. Terry, Jr., Ph.D.
Graduate Advisor
doterry@temple.edu
215-204-8226

Chairperson:

Nicholas Davatzes, Ph.D.
nicholas.davatzes@temple.edu
215-204-2319

Courses

EES 5011. Remote Sensing and GIS. 4 Credit Hours.

The focus of this class is on remote sensing technologies and geographic information systems. Remote sensing is a dynamic field; new, high-resolution satellites are coming on line almost daily, and there has been an exponential growth in applications of remote sensing data during the past decade, including: mineral exploration, precision agriculture, watershed management, land use classification, military intelligence, and climate monitoring. By the end of the semester you will have a fundamental understanding of the uses and limitations of remote sensing data for environmental applications, and a thorough familiarity with geographic information systems.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5015. Drone Shortcourse. 1 Credit Hour.

Drones are everywhere. This course offers a short introduction to use of drones, otherwise known as unmanned aerial vehicles (UAVs). Students will be taught use of drones in research and other societal applications, basics of flight and operation of drones, and regulations applicable to drone usage. This course does not provide certification to become a drone pilot, but the steps to certification will be reviewed. Flying experience will be provided through labs conducted at the Ambler campus. Students will complete a project involving video or photography using a drone. This course is typically offered in Spring Semester.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5042. Coastal Processes. 4 Credit Hours.

The course will apply a process geomorphological approach to understanding coastal behavior, including global distribution of coasts, wave and tidal hydrodynamics, nearshore and aeolian sediment transport, and morphological signatures of extreme events.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5101. Structural Geology (Graduate). 4 Credit Hours.

The purpose of this course is to train students in the concepts and techniques of structural geology. Students will learn how to collect, analyze, and interpret geologic data drawn from a variety of disciplines pertinent to structural geology and present a cohesive analysis and interpretation of these results. Results are presented as maps, reports, and computer models. A hypothesis driven term project will be conducted by the graduate student on a topic in structural geology. NOTE: This course differs from the undergraduate version EES 4101 through graduate specific laboratory and exam questions, readings, and the term project.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5401. Analytical Methods in Mineralogy. 4 Credit Hours.

An introduction to the theory and application of X-ray diffraction and spectroscopic techniques for analysis of mineralogical samples. Students will learn the theory underpinning these methods, acquire skills in instrument operation, and apply these skills to research-relevant problems such as phase identification, site occupancy, chemical analysis, and planetary surface studies. Techniques discussed include powder X-ray diffraction, visible, Raman, and infrared spectroscopy, and synchrotron-based X-ray spectroscopic and scattering techniques.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5402. X-ray Crystallography. 4 Credit Hours.

Generation and use of x-rays for diffraction analysis; Analysis of clays and related minerals by x-ray diffraction; Crystal structure patterns and biogeofunctional groups.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5406. Nanoscience and the Environment. 4 Credit Hours.

Nanotechnology has developed rapidly in the past decade, yet our knowledge of its environmental impact, particularly regarding the fate and behavior of nanomaterials in the environment, lags far behind. This course will cover a range of topics concerning nanomaterials in the environment, ranging from the unique size-dependent properties of nanomaterials to their applications in environmental remediation. The lab component of this course will include nanomaterial synthesis and characterization; nanomaterial transport, aggregation, deposition, transformation, and persistence in natural settings; environmental applications of nanomaterials; and nanomaterial characterization techniques, particularly electron microscopy.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5434. Ecohydrology. 3 Credit Hours.

Hydrological and ecological processes are tightly interrelated, with vegetation affecting the hydrological cycle, and hydrologic partitioning of the water budget affecting vegetation dynamics. This course builds on perspectives from ecology, hydrology, and soil science to focus on the emerging, interdisciplinary area of ecohydrology - the science that studies mutual interaction between the hydrological cycle and ecosystems. The first part of the course will deal with fundamental processes controlling the flow of water in the biosphere (in land, atmosphere, soil and plants) and the interactions with ecological processes and human dimensions at different scales. The second part will deal with the implications of ecohydrological feedbacks, covering a broad range of issues including global environmental change, land use change, global desertification/land degradation, urbanization, soil erosion, and the food-energy-water nexus. The concepts and principles discussed in the class will have broad applications ranging from finding innovative solutions to ecosystem degradation and food security, and designing global change responses.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5454. Introduction to Geophysics. 4 Credit Hours.

An introduction to gravity, magnetic, electromagnetic, and seismic exploration methods. Applications include environmental characterization, oil and mineral exploration, geotechnical engineering, and archeology.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5461. Low-Temperature Geochemistry. 4 Credit Hours.

Principles of aqueous geochemistry discussed within the framework of geologic processes. One or two field trips.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5462. Advanced Low-Temperature Geochemistry. 3 Credit Hours.

Study and discussion of topics in aqueous and sedimentary geochemistry.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5502. Glaciology. 3 Credit Hours.

This course presents the basic physical principles governing natural processes occurring to and within glaciers and ice sheets on Earth, and how they interact with the surrounding environment. The following major topics will be covered during the course: 1) the deformation and flow of ice; 2) energy transfer within ice and energy exchanges with the surroundings; and 3) ice geomorphic processes.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5601. Vertebrate Paleontology and Taphonomy. 3 Credit Hours.

This course examines vertebrate fossils and their importance for interpreting and reconstructing terrestrial ecosystems. Students will learn the basics of vertebrate skeletal anatomy, interpret transport and depositional histories of skeletal elements and assemblages, and combine this information with geologic data to reconstruct paleoenvironmental settings and paleocommunity associations. Several class sessions will meet off-campus at local museums; one weekend field trip is required.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5625. Electron Optical Techniques. 4 Credit Hours.

This course will introduce the microanalytical and imaging methods of electron optical instruments such as the Electron Probe Microanalyzer (EPMA) and the Scanning Electron Microscope (SEM). The theory and operation of the instruments will be covered as will the interpretation of images and analytical results.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5702. Sedimentary Petrology. 4 Credit Hours.

This course explores the basic composition and texture of sedimentary rocks in order to understand depositional environment and provenance. This course focuses on sedimentation mechanics, petrography, and diagenesis. Includes a lab.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5725. Soils and Paleosols. 4 Credit Hours.

The course is divided into two parts: modern soils and paleosols. The goals of this course are to teach students the fundamentals of modern soil genesis and classification in order to interpret ancient soils preserved in the rock record (paleosols), and to incorporate models of soil genesis into the traditional geology paradigm. Students will be exposed to a combination of laboratory methods and field work.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5801. Quantitative Structural Geo. 4 Credit Hours.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5802. Tectonics. 3 Credit Hours.

Plate tectonic theory. Structure and geometry of lithospheric plates; mechanisms of divergent, transform and convergent boundaries; subduction; obduction; mantle plumes; large igneous provinces; large sedimentary basins and Phanerozoic orogenic belts.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 5811. Planetary Geology. 4 Credit Hours.

This course explores the modern and ancient geologic processes on other planets and discusses how studies of other planets can aid us in a better understanding of our Earth. The course will also cover topics such as planetary exploration and astrobiology. Includes a lab.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 8000. Geology Seminar. 1 Credit Hour.

Required of M.A. students. Visiting specialists in a wide variety of geologic fields will lecture and discuss their research.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

EES 8082. Independent Study Program. 1 to 3 Credit Hour.

Limited to Geology graduate students with permission from the department.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

EES 8200. Graduate Geology Seminar. 3 to 6 Credit Hours.

Advanced seminar course; subject matter varies from semester to semester. The educational objectives of the course are to focus on current issues at the interfaces of geological processes through advanced technological methods of analysis.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

EES 8411. Advanced Hydrogeology. 3 to 4 Credit Hours.

This course is typically offered in Spring.

This course covers water resources with an emphasis on groundwater. Topics include quantifying groundwater flow, groundwater-surface water interactions, contaminant transport, and a brief introduction to modeling. Problem sets and labs are used to develop specific skills, including field techniques.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 8421. Groundwater Modeling. 3 Credit Hours.

This course offers students a chance to construct models using well known codes such as MODFLOW and other practical tools. The goals of this course are: learn tools for groundwater flow modeling, be able to recognize how to judge models and compare them with reality, and gain computer skills that can be used with a wide variety tools.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 8701. High Temperature Reactions. 4 Credit Hours.

Thermodynamic laws and theory are used to discuss igneous and metamorphic processes. Exact field relationships are combined with thermodynamics to solve applied petrologic problems.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 8706. Regional Geology. 3 Credit Hours.

Discussion of the geologic history and tectonics of selected regions.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 8711. Economics of Geo Ore Deposits. 3 Credit Hours.

Study of the geology, origin, distribution, economics and extraction methods of major classes of ore deposits.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 8911. Teaching of Geology. 0 to 1 Credit Hours.

Required of all teaching assistants in their first semester of teaching. Instruction and evaluation of teaching laboratory, or discussion sections.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

EES 9991. Master's Research Projects. 1 to 6 Credit Hour.

Short-term, limited research project or laboratory project in the field. This course is not the capstone project course, nor can it be used for thesis based research. The course is for master's students only, including PSM, MA or MS. This class will not confer full-time program status unless nine credits are taken.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Degree Restrictions: Must be enrolled in one of the following Degrees: Master of Arts, Master of Science, Prof Science Masters.

Repeatability: This course may be repeated for additional credit.

EES 9993. Comprehensive Examination Prep. 1 Credit Hour.

This 1-credit seminar is designed to prepare students for the MS Comprehensive Exam given at the end of this course, ensuring a fundamental grounding in Earth Science. Students will study material covered in the exam including hydrogeology, geophysics, sedimentology/stratigraphy, earth history, geomorphology, structural geology, GIS, geochemistry, mineralogy and petrology. MS students will take this course in the Spring semester of their first year.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

EES 9994. Preliminary Examination Preparation. 1 to 6 Credit Hour.

This course is required for students who are preparing for the preliminary or candidacy examination. Students should enroll after coursework is completed or when preparing for the candidacy exam until the time that the preliminary or candidacy examination is completed. This course will confer full-time status at the minimum credit hour registration limit of one credit. All students must complete a minimum of one credit of this course. Students must complete a total of 6 credit hours of 9994, 9998 and 9999.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Degree Restrictions: Must be enrolled in one of the following Degrees: Doctor of Philosophy.

Repeatability: This course may be repeated for additional credit.

EES 9995. Capstone Project. 1 to 6 Credit Hour.

Capstone project for master's students including students in PSM, MA or MS. This class will provide full-time status. Students in PSM programs need to register for at least one credit of this course to fulfill program requirements. Additional credits may be required for specific programs. This course will confer full-time status at the minimum credit hour registration limit of one credit.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Degree Restrictions: Must be enrolled in one of the following Degrees: Master of Arts, Master of Science, Prof Science Masters.

Repeatability: This course may be repeated for additional credit.

EES 9996. Master's Thesis Research. 1 to 6 Credit Hour.

Course for master's thesis research. Only intended for students in thesis bearing master's programs. A minimum of one credit is required. This course will confer full-time status at the minimum credit hour registration limit of one credit.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

EES 9998. Pre-Dissertation Research / Elevation to Candidacy. 1 to 6 Credit Hour.

This course is intended for students who are performing research prior to candidacy. Students can register for this course after required courses are completed. This course will confer full-time status at the minimum credit hour registration limit of one credit. Students must be registered for this course during the semester that they are to be elevated to candidacy examination. Students must complete a total of 6 credit hours of 9994, 9998 and 9999.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Degree Restrictions: Must be enrolled in one of the following Degrees: Doctor of Philosophy.

Repeatability: This course may be repeated for additional credit.

EES 9999. Dissertation Research. 1 to 6 Credit Hour.

The course is for Ph.D. students who have been elevated to candidacy. During the course of their candidacy students must complete a minimum of two credits of dissertation research. This course will confer full-time status at the minimum credit hour registration limit of one credit. Students must complete a total of 6 credit hours of 9994, 9998 and 9999.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Degree Restrictions: Must be enrolled in one of the following Degrees: Doctor of Philosophy.

Student Attribute Restrictions: Must be enrolled in one of the following Student Attributes: Dissertation Writing Student.

Repeatability: This course may be repeated for additional credit.