

# GEOLOGY, MINOR

## Program Description

The mission of the Geology Program is to provide integrated and process-oriented curricula, based on fundamental scientific principles and processes that enable graduates to pursue challenging careers and maintain lifelong learning. The Geology Program is designed to serve students majoring in geology and environmental science as well as students in other fields who are interested in adding to their knowledge of the Earth. Support is also provided for students preparing to earn certification for teaching at the K-12 level, and interested non-science majors. Members of the geoscience faculty provide majors with a broad overview of geologic processes while offering the opportunity to pursue specialized knowledge in selected areas of geoscience in preparation for graduate study and careers in government, industry, or academia.

## Program Requirements

Students majoring in other academic fields who wish to earn a minor in geology must complete the following requirements:

Code	Title	Hours
<b>Required Courses</b>		
GEOL 1403	Physical Geology	4
GEOL 1404	Historical Geology	4
GEOL 3411	Mineralogy	4
GEOL 3443	Environmental Geology	4
GEOL 4421	Structural Geology <sup>1</sup>	4
<b>Total Hours</b>		<b>20</b>

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Note: GEOL 4421 can be substituted by other 4000 level Geology courses such as: GEOL 4411 Sedimentation and Stratigraphy or GEOL 4444 Hydrogeology or GEOL 4422 Geophysics, or GEOL 4416 Introduction to Geochemistry or 3000 level courses that have a field component such as GEOL 3326 Introduction to Field Methods or GEOL 3441 Invertebrate Paleontology or GEOL 3414 Igneous and Metamorphic Petrology.

## Courses

### GEOL 1303 Essentials of Geology

#### 3 Semester Credit Hours (3 Lecture Hours)

One-semester introductory Earth science course for students majoring in a non-science subject area. Covers basic geologic material and concepts, such as minerals, rocks, the rock cycle, and plate tectonics theory. Origin, composition, and evolution of our planet, as well as the importance of geology in everyday life, including geologic resources, global change, earthquakes, and volcanism are examined. This course is not recommended for students majoring in Geology or Environmental Sciences. Course counts toward the natural science component of the Core Curriculum Program.

TCCNS: GEOL 1303

### GEOL 1403 Physical Geology

#### 4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)

Introduction to the origin, classification, and composition of Earth materials. Study of internal and surface processes which shape and modify Earth. Laboratory studies of minerals and rocks, as well as topographic maps, geologic maps and geologic cross-sections.

**Co-requisite:** SMTE 0094.

TCCNS: GEOL 1403

### GEOL 1404 Historical Geology

#### 4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)

Introduction to the origin and evolution of Earth and other planets. Changes in the form and distribution of Earth's continents and oceans, and succession of plants and animals through geologic time. Laboratory studies of fossils, geological maps, and the interpretation of ancient environments of rock formation.

**Prerequisite:** GEOL 1403 or 1303.

**Co-requisite:** SMTE 0094.

TCCNS: GEOL 1404

### GEOL 2102 Undergraduate Seminar in Geology-Careers in the Geosciences

#### 1 Semester Credit Hour (1 Lecture Hour)

Introductory level seminar featuring diverse topics and speakers. Focus on careers in the geosciences as well as on how to successfully plan a college career. In-house as well as external speakers. May not be repeated for credit but attendance in subsequent semesters is encouraged.

### GEOL 2103 Undergraduate Seminar in Geology-Research in the Geosciences

#### 1 Semester Credit Hour (1 Lecture Hour)

Introductory level seminar featuring diverse topics and speakers. Focus on current geologic research. In-house as well as external speakers. May not be repeated for credit but attendance in subsequent semesters is highly encouraged. Credit/no credit

### GEOL 2222 Karst Geology and Paleoclimatology

#### 2 Semester Credit Hours (1 Lecture Hour)

This course describes the different types of caves and karst rocks, the water rock interactions in carbonate rock systems, and it explains cave formation via hydrological and geochemical processes. It also deals with how speleothem proxies such as oxygen and carbon stable isotope, trace elements, carbonate petrography are used to decipher past changes in climate.

### GEOL 2490 Selected Topics

#### 1-4 Semester Credit Hours (1-4 Lecture Hours, 6 Lab Hours)

May be repeated for credit if topics are significantly different. Subject material variable. Faculty approval required.

### GEOL 3326 Introduction to Geological Field Methods

#### 3 Semester Credit Hours (2 Lecture Hours, 3 Lab Hours)

Introduction to the basic techniques of geological fieldwork. Note taking in the field, proper use of geological field equipment, measurement and description of rock sections by several methods and degrees of detail, plus small area mapping of several types of terrain with topographic maps. Reports, sections, and maps will be produced from the field notes. Field trips required.

**Prerequisite:** GEOL 1403 and 1404 and (GEOL 3411 or 3411\*).

\* May be taken concurrently.

**Co-requisite:** SMTE 0094.

**GEOL 3329 Geology of National Parks****3 Semester Credit Hours (3 Lecture Hours)**

Introduction to the regional geology of the United States using selected U.S. National Parks representing a wide variety of geologic settings as examples. Application of major geologic principles and basic geologic concepts such as plate tectonics, rock cycle, stratigraphy, and geologic time.

**Prerequisite:** GEOL 1303, 1403 or 1404.

**GEOL 3411 Mineralogy****4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Study of the physical and chemical properties of minerals. Introduction to the crystallography of minerals, optical mineralogy, and the use of the polarized light microscope. Laboratory study of mineral identification in hand specimens and thin sections.

**Prerequisite:** GEOL 1403 and CHEM 1411 and (CHEM 1412 or 1412\*).

\* May be taken concurrently.

**Co-requisite:** SMTE 0094.

**GEOL 3414 Igneous and Metamorphic Petrology****4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Genesis and occurrence of igneous and metamorphic rocks. Mineralogical composition and thermodynamics of geologic systems. Determination of rock types in hand specimens and thin sections.

**Prerequisite:** GEOL 1403, CHEM 1411, 1412 and GEOL 3411.

**Co-requisite:** SMTE 0094.

**GEOL 3441 Invertebrate Paleontology****4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Morphology, classification, and paleoecology of fossil invertebrates. Applications to marine geology including paleoceanography, stratigraphy, economic geology. Field trip to Texas invertebrate fossil beds.

**Prerequisite:** GEOL 1404.

**Co-requisite:** SMTE 0094.

**GEOL 3442 Geomorphology****4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Study of landscapes and landforms at the surface of the Earth, and the processes and mechanisms by which they are developed.

**Prerequisite:** GEOL 1403.

**Co-requisite:** SMTE 0094.

**GEOL 3443 Environmental Geology****4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Study of the relationships of humans to Earth's physical environment. Geologic aspects of waste disposal, resources, conservation, land reclamation, geologic hazards, and land-use planning.

**Prerequisite:** GEOL 1403.

**Co-requisite:** SMTE 0094.

**GEOL 3490 Selected Topics****1-4 Semester Credit Hours (1-4 Lecture Hours)**

May be repeated for credit if topics are significantly different. Subject materials variable.

**GEOL 4311 Paleoclimatology****3 Semester Credit Hours (3 Lecture Hours)**

Reconstruction of Earth's climate system through time using natural archives and proxy evidence. Focus is mostly towards the Quaternary, though longer time spans will be considered, too. Mixed format with lectures, hand-on activities involving paleoclimate data sets, and seminar-style readings and discussions.

**Prerequisite:** GEOL 1403, ATSC 4335\* or ESCI 4335\*.

\* May be taken concurrently.

**GEOL 4316 Marine Geoscience****3 Semester Credit Hours (3 Lecture Hours)**

Introduction to the geology of the marine environment. Review of plate tectonic processes relevant to the evolution of continental margins and plate boundaries; geophysics and ocean morphology; geology of ocean crust; controls on the types, origin, and distribution of marine sediments; marine geochemistry; nearshore geological processes and the continental shelf; introduction to paleoceanography; global paleoceanographic evolution; critical events in ocean history. Special focus on the Gulf of Mexico.

**Prerequisite:** GEOL 1403, 1404, CHEM 1411 and 1412.

**GEOL 4321 Introduction to Soil and Groundwater Restoration****3 Semester Credit Hours (3 Lecture Hours)**

Introduction to methods for restoring contaminated soil and groundwater by examining the factors and processes influencing the efficacy of remediation systems. An emphasis will be placed on the scientific principles upon which soil and groundwater remediation is based.

**Prerequisite:** (GEOL 1403, CHEM 1411, 1412 and GEOL 3443).

**GEOL 4411 Sedimentation and Stratigraphy****4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Composition and origin of sediments and sedimentary rocks. Description and classification of rocks in hand specimen. Principles of stratigraphy, including stratigraphic units and correlation. Facies models for major depositional systems. Field trips.

**Prerequisite:** (GEOL 1403) and (GEOL 1404) and (GEOL 3411\*).

\* May be taken concurrently.

**Co-requisite:** SMTE 0094.

**GEOL 4415 Economic Geology****4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Study of geologic and tectonic parameters of mineral and metals formation. Ore geology and geochemistry. Mining, processing, fabrication, and marketing of natural resources. Field trip to mining operations.

**Prerequisite:** GEOL 1403 and 3411.

**Co-requisite:** SMTE 0094.

**GEOL 4416 Introduction to Geochemistry****4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Introductory study of the Earth processes using principles of chemical equilibrium, thermodynamics, isotope geochemistry and organic geochemistry. Applications of low-temperature geochemistry to geologic problems.

**Prerequisite:** CHEM 1411, 1412 and MATH 2413.

**Co-requisite:** SMTE 0094.

**GEOL 4421 Structural Geology****4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

PHYS 1401 Geometric and quantitative description of deformation of the Earth's crust, mechanics of brittle and crystal-plastic deformation processes of Earth materials, introduction to continuum mechanics of geologic systems, crustal deformation from micro-scale to global tectonics. Laboratory introduces principles of three-dimensional data representation and analysis, geologic map interpretation, cross-section techniques, and problems in stress and strain analysis.

**Prerequisite:** GEOL 3411 and MATH 2413 and (PHYS 1401 or 2425).

**Co-requisite:** SMTE 0094.

**GEOL 4422 Geophysics****4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Introduction to quantitative techniques to assess physical properties and processes of the Earth. Topics include earthquake seismology, refraction and reflection seismology, gravimetry, magnetism, electrical methods, and radioactivity of Earth materials. Application of geophysical methods to the study of the Earth, in oil and gas exploration, and in economic and environmental geology.

**Prerequisite:** (GEOL 4421, PHYS 1401 or 2425) and (PHYS 1402 or 2426) and (MATH 2413).

**GEOL 4423 Seismic Methods****4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Introduction to the acquisition, processing, and interpretation of 2D and 3D seismic data. Lectures and field exercises are covered. Topics include conceptual and historical foundations of modern reflection seismology; an overview of seismic wave phenomena in acoustic, elastic, and porous media; acquisition principles for land and marine seismic surveys; methods used to create 2D and 3D seismic images from field data; concepts of dip moveout, prestack migration, and depth migration; concepts and limitations of 3D seismic interpretation for structure, stratigraphy, and rock property estimation; and the interpretation role of attributes, impedance estimation, and AVO.

**Prerequisite:** GEOL 4422.

**GEOL 4424 Environmental and Engineering Geophysics****4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Geophysical techniques for exploring the shallow subsurface for environmental and engineering purposes. Topics include seismic, resistivity, ground penetrating radar, electromagnetic, gravity, and magnetic methods. This course includes both lectures and labs (field exercises) components.

**Prerequisite:** (PHYS 1401 or 2425) and (PHYS 1402 or 2426) and (MATH 2413).

**GEOL 4430 Internship in Geology****1-4 Semester Credit Hours**

One to four semester hours of credit may be earned by working in an internship position in industry, with local government, a private firm, or an independent geologist.

**GEOL 4436 Introduction to Petroleum Geology****4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Basic concepts of petroleum geology and techniques used in the exploration and production of hydrocarbon systems. Lectures and lab exercises will cover principles of stratigraphy, sedimentology, hydrocarbon generation, hydrocarbon-trapping mechanisms, reservoir characterization, seismic interpretation, well-log interpretation, and geologic risk analysis.

**Prerequisite:** GEOL 4411 or 4411\*.

\* May be taken concurrently.

**Co-requisite:** SMTE 0094.

**GEOL 4444 Hydrogeology****4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Introduction to the fundamentals of groundwater and surface water flow; well hydraulics and evaluation of groundwater as a resource; chemical properties of groundwater and groundwater contamination; groundwater and the environment; and groundwater modeling. This course also examines some of the techniques associated with field hydrogeology and laboratory methods in hydrogeology.

**Prerequisite:** GEOL 1403 and (PHYS 1401 or 2425).

**Co-requisite:** SMTE 0094.

**GEOL 4490 Selected Topics****4 Semester Credit Hours (1-4 Lecture Hours, 1-4 Lab Hours)**

May be repeated for credit if topics are significantly different. Subject materials variable.

**GEOL 4496 Directed Independent Study****1-4 Semester Credit Hours**

DIRECTED INDEPENDENT STUDY Requires a formal proposal of study to be completed in advance of registration and to be approved by the supervising faculty, the chairperson, and the Dean of the College.

**GEOL 4649 Karst of the Yucatan Peninsula****6 Semester Credit Hours (3 Lecture Hours, 6 Lab Hours)**

This course describes the different types of caves and karst rocks, the water rock interactions in carbonate rock systems, and it explains cave formation via hydrogeological and geochemical processes. It offers field work experience such as sample collection, determining field parameters, karst and cave surveys, measuring spring discharges in the Yucatán Peninsula of Mexico and laboratory experience on the Texas A&M University-Corpus Christi campus.

**Prerequisite:** (GEOL 1403 and 4411) or GEOL 4444, 4416 or 4311.

**GEOL 4650 Field Geology****6 Semester Credit Hours (12 Lab Hours)**

Field course involving practical application of geologic principles to field problems. Locations visited and material covered depends on hosting institution. Generally should include: mapping and data collection; measurement of stratigraphic sections; mapping and preparation of geologic cross-sections; preparation of geologic reports.

**Prerequisite:** GEOL 3326, 4411, 4421, 4416, 4444 or 4422.

**Co-requisite:** SMTE 0094.