

# GEOLOGY (GEOL)

## Geology Undergraduate Courses

### GEOL 1010 ENVIRONMENTAL GEOLOGY (3 credits)

This is an introductory course for non-majors designed to make students aware of their physical environment and those factors that should influence where we site our home and communities. Topics will include hazards associated with volcanoes, earthquakes, landslides, floodplains and the problems associated with toxic waste disposal.

**Distribution:** Natural/Physical Science General Education course

### GEOL 1100 EARTH SYSTEM SCIENCE (3 credits)

This course is an introduction to system science as applied to the earth. Students learn about simple earth system models, focusing on the hydrologic, rock and carbon cycles and energy flow through and linkages among them. Students also learn how short and long term global changes result from system interactions.

**Distribution:** Natural/Physical Sci General Education lecture

### GEOL 1104 EARTH SYSTEM SCIENCE LAB (1 credit)

This laboratory course is an optional companion to GEOL 1100, Earth System Science, but can be taken alone. Computer and web based exercises lead students through scientific investigation of Earth components, processes and systems. Topics include: scientific visualization and methodology, energy flow in the earth environment, convection in fluids, population dynamics, plate tectonics, river systems, coastal systems, biodiversity and Earth system history.

**Distribution:** Natural/Physical Sci General Education lab course

### GEOL 1170 INTRODUCTION TO PHYSICAL GEOLOGY (4 credits)

Fundamentals of geology. The study of the internal geologic processes and external and erosional and depositional processes which create the subsurface and surface features of the earth. Fundamentals of contour mapping, topographic map interpretation and identification of common minerals and rocks will be covered in a required laboratory period. One field trip required.

**Distribution:** Natural/Physical Sci General Education lecture&lab

### GEOL 1180 INTRODUCTION TO HISTORICAL GEOLOGY (4 credits)

Basic fundamentals for interpretation of earth history. Deduction of history of earth-moon system through interpretation of geologic phenomena using principles of stratigraphy, sedimentation, structure and fossil content. Global tectonics, encompassing theories of sea-floor spreading and continental drift are presented. Fundamentals and interpretation of geologic environments and geologic maps, coupled with identification of fossils will be covered in a required laboratory period. One Saturday field trip required.

**Prerequisite(s):** GEOL 1170 or GEOL 1070 or permission of Geography-Geology Department.

### GEOL 2014 ENVIRONMENTAL GEOLOGY LAB (1 credit)

Basic topics such as geohydrology, water quality, waste management (including landfill siting and design), flood frequency, slope stability and earthquake hazards are covered via labs and field trips at a detailed introductory level. Local sites and associated data are used where possible to illustrate fundamental principles and commonly used analytic techniques.

**Prerequisite(s):** GEOL 1010 or GEOG 1170 or GEOG 1030 or permission of instructor.

### GEOL 2100 GEOLOGY OF NEBRASKA (3 credits)

An introduction to the geologic features of Nebraska, and how the evidence they provide can be used to scientifically interpret the ancient history of the region. A review of the geologic history of Nebraska as it is currently understood will place the events documented in the larger context of Earth history.

**Distribution:** Natural/Physical Science General Education course

### GEOL 2300 GEOSCIENCE DATA ANALYSIS AND MODELING (3 credits)

Introduction to foundation geoscience analysis and modeling techniques and conceptual frameworks. Topics covered include: describing and comparing populations, geologic map construction, fractals, surface contouring and modeling, non-linear behavior, GIS, graphic representation, photogrammetry, and computer modeling. Examples and exercises work with actual geoscience data. Students also gain experience with data retrieval from geoscience databases.

**Prerequisite(s):** GEOL 1010 or GEOL 1170, or GEOG 1030 or GEOG 1060 or GEOG 1070, or permission of instructor.

### GEOL 2500 SPECIAL TOPICS IN GEOGRAPHY-GEOLOGY (1 credit)

This course will provide for an in-depth study of a geographical or geological subject (as specified in the course subtitle). Various classes will be offered as sections of GEOL 2500, but will be separate from one another. Students may repeat GEOL 2500 as often as they like as long as no specific subject is duplicated.

**Distribution:** Natural/Physical Science General Education course

### GEOL 2750 MINERALOGY (3 credits)

Introduction to crystallography and mineralogy. Crystallography section is a study of crystal structure, symmetry and crystal systems. Mineralogy section is devoted to the description, identification and classification of minerals based on their crystal forms, physical properties, chemical composition and occurrence in nature. Must be taken concurrently with GEOL 2754.

**Prerequisite(s):** GEOL 1170. Must be taken concurrently with GEOL 2754.

### GEOL 2754 MINERALOGY LABORATORY (1 credit)

A systematic investigation of minerals and the techniques of studying minerals to be taken concurrently with GEOL 2750. (Fall)

**Prerequisite(s):** Concurrent enrollment in GEOL 2750

### GEOL 2760 IGNEOUS AND METAMORPHIC PETROLOGY (3 credits)

A study of the nature, origin, and significance of igneous and metamorphic rocks. Topics include genesis and crystallization of magmas, phase equilibria of mineral assemblages, and pressure and temperature conditions of metamorphism. One weekend field trip will be required. Must be taken concurrently with GEOL 2764.

**Prerequisite(s):** GEOL 2750. Must be taken concurrently with GEOL 2764.

### GEOL 2764 IGNEOUS AND METAMORPHIC PETROLOGY LABORATORY (1 credit)

Petrology Laboratory is an introduction to the methods of petrology with emphasis on hand specimen identification and use of the petrographic microscope. Must be taken concurrently with GEOL 2760. (Spring)

**Prerequisite(s):** Concurrent enrollment in GEOL 2760

### GEOL 3100 PALEONTOLOGY (3 credits)

An introduction to the history of life through the study of the fossil assemblages, communities, diversity, evolution, extinction, and how fossils are created. We then explore the history of invertebrates, vertebrates, microfossils, and mass extinctions. (Cross-listed with BIOL 3100).

**Prerequisite(s):** GEOL 1180 or with instructor permission

### GEOL 3104 INVERTEBRATE PALEONTOLOGY LABORATORY (1 credit)

An examination of representative specimens of groups of organisms important in the fossil record and an introduction to analytical techniques in paleontology. Must be taken concurrently with GEOL 3100. (Cross-listed with BIOL 3104).

**Prerequisite(s):** GEOL 1180 or permission; Concurrent enrollment in GEOL 3100

### GEOL 3300 STRUCTURAL GEOLOGY (3 credits)

A study of the deformation of rocks in the earth's crust. Recognition of structural features such as types of fractures, folds, faults and foliations. Analysis of stress and strain in rocks under physical conditions occurring in the earth's crust that form structural features. Knowledge of structural associations for crustal shortening, extension and other kinematic regimes.

**Prerequisite(s):** GEOL 2750

**GEOL 3310 STRUCTURAL GEOLOGY FIELD METHODS (1 credit)**

A lab course to accompany GEOL 3300. Field trip is included. Emphasis will be on collection, interpretation and presentation of field and lab data. Must be taken concurrently with GEOL 3300.

**Prerequisite(s):** GEOL 2750, concurrent enrollment in GEOL 3300.

**GEOL 3400 INTRODUCTION TO SEDIMENTARY GEOLOGY (3 credits)**

An introduction to the basic principles and concepts of sedimentology and stratigraphy. It will include a review of sedimentary processes and depositional environments and principles and techniques of stratigraphy, such as biostratigraphy and radiometric dating.

**Prerequisite(s):** GEOL 2750 and GEOL 2754

**GEOL 3700 PLATE TECTONICS (3 credits)**

An introduction to and analysis of the paradigm that has revolutionized the Earth Sciences, the theory of plate tectonics; includes polar wandering and magnetic reversals, structure and life cycle of the oceanic crust, origin of major topographic and structural features of the earth, arc volcanism, continental collisions, mineral deposits, supercontinent cycles and mantle convection.

**Prerequisite(s):** GEOL 1170, GEOL 1180 and upper division standing.

**GEOL 4040 GEOARCHAEOLOGY (3 credits)**

An introduction to geoarchaeology: the application of methods and techniques of geography, geology and other earth sciences to solve archaeological problems and reconstruct past environments. (Cross-listed with GEOG 4040, GEOG 8046).

**Prerequisite(s):** Major in geology or geography; or major in anthropology, philosophy, or religion with GEOG 1030, GEOG 1060 or GEOG 1070; or GEOL 1170 or GEOL 1010; or permission.

**GEOL 4100 BIOGEOGRAPHY (3 credits)**

This course is intended as an introduction to biogeography, the study of the distribution and evolution of organisms across space and through time. Usually offered every year. (Cross-listed with GEOL 8106, BIOL 4100, BIOL 8106, GEOG 4100, GEOG 8106).

**Prerequisite(s):** BIOL 1450 and BIOL 1750 or GEOL 3100 or BIOL 3100, junior-senior.

**GEOL 4200 WATER QUALITY (3 credits)**

This class will apply chemical principles to the aquatic environment to understand how and why water quality varies. Integrated lectures and labs will focus on completing a class-defined, locally-explorable water quality project. Students will also gain basic water sampling and analysis skills. (Cross-listed with GEOG 8206, GEOG 4200).

**Prerequisite(s):** One of the following: GEOL 2750, GEOL 4540, CHEM 1140, CHEM 1180, or instructor permission.

**GEOL 4260 PROCESS GEOMORPHOLOGY (4 credits)**

A lecture and laboratory course focused on understanding Earth surface processes and the evolution of landforms across spatial and temporal scales. The course emphasizes applying unifying concepts in geomorphology, quantitative methodology and modern process-oriented geomorphology to interpret landscape evolution. (Cross-listed with GEOG 8266, GEOG 4260).

**Prerequisite(s):** One of the following: GEOL 1010, GEOL 1170, GEOG 1030, GEOG 1050 or instructor permission.

**GEOL 4300 ENGINEERING GEOLOGY (3 credits)**

The course provides an overview of the application of geologic principles to engineering projects and applications. These would include geologic investigations for engineering projects related to: geologic hazard assessment, foundation design, slope stability, control of groundwater seepage, underground excavation support, erosion control, and evaluation of geologic materials for engineering purposes.

**Prerequisite(s):** Physical Geology (GEOL 1170) or Environmental Geology (GEOL 1010), Structural Geology (GEOL 3300) or permission of instructor.

**GEOL 4330 SOIL GENESIS, MORPHOLOGY AND CLASSIFICATION (4 credits)**

This course is designed to familiarize students with basic soil chemical, physical and biological properties, soil morphological characteristics, soil classification and soil forming processes. The course focuses on relationships between soils and environmental factors and how such factors alter soil forming processes. The lab will focus on developing basic field skills, including soil morphological descriptions and soil mapping, as well as common laboratory methods used to analyze soils. (Cross-listed with GEOG 4330, GEOG 8336)

**Prerequisite(s):** One of the following: GEOG 1030, GEOG 1050, GEOL 1010, GEOL 1170 or instructor permission.

**GEOL 4400 GEOPHYSICS (3 credits)**

A study of geophysical techniques used to understand the earth, study environmental problems, and in resource exploration. Seismic, gravity, heat flow, magnetic and other methods will be presented. The insights from these methods into earthquake events, stress distributions, rock rheology and plate tectonics will also be addressed. Interpretive skills will be emphasized. (Cross-listed with PHYS 4400).

**Prerequisite(s):** GEOL 1170, PHYS 1110 or higher, or permission of instructor

**GEOL 4450 GEOHYDROLOGY (3 credits)**

A course dealing with geology, chemistry and hydraulics of groundwater. Designed mainly for Geology majors but can be helpful to other disciplines where ground water is involved. (Cross-listed with GEOG 8456, GEOG 4450).

**Prerequisite(s):** MATH 1320 or higher, or permission of instructor

**GEOL 4500 PALEOCLIMATOLOGY (3 credits)**

Paleoclimatology involves the study of Earth's past climate history to better understand modern climate change. The course explores how we know climate changed in the past using geologic and geochemical proxies and then investigates the Earth's past climates from its birth to modern anthropogenic climate change. The course involves lecture, activities, and critical assessment of scientific literature to better understand Earth's dynamic past.

**Prerequisite(s):** GEOL 1170 or GEOL 1180

**GEOL 4540 GEOCHEMISTRY (3 credits)**

This course will cover the application of chemical principles to geologic systems. Specific topics covered will include the origin of elements and their distribution in the earth, geochronology, stable isotope systems, aqueous geochemistry and crystal chemistry. These topics will be integrated to the study of soils, igneous, metamorphic and sedimentary rocks and ore deposits. (Every third semester). (Cross-listed with CHEM 4540).

**Prerequisite(s):** GEOL 1170, CHEM 1140 or CHEM 1180, and either GEOL 2750 or CHEM 2500, or permission of Instructor

**GEOL 4600 INDEPENDENT RESEARCH (1-3 credits)**

Advanced study in the form of a major paper to give the senior student knowledge of and experience in using government documents, professional, and/or primary materials on a topic. Must be under the supervision of the instructor who is particularly qualified for the topic chosen. (Cross-listed with GEOG 4600).

**Prerequisite(s):** Permission of department chair.

**GEOL 4610 ENVIRONMENTAL MONITORING AND ASSESSMENT (3 credits)**

An interdisciplinary approach to techniques for the design and implementation of environmental inventory and monitoring schemes used to evaluate natural resources. Students work as teams to synthesize information from their backgrounds in geography, geology and ecology to evaluate the impacts of human actions on environmental quality following the framework for environmental assessments provided by the National Environmental Policy Act. Course is organized to accommodate variable needs of students with different backgrounds and career choices. Usually offered every year. (Cross-listed with BIOL 4610, ENVN 4610, GEOG 4610, GEOG 8616, GEOL 8616).

**Prerequisite(s):** Permission of instructor.

**GEOL 4620 ADVANCED FIELD COURSE (6 credits)**

Six weeks of advanced study on selected field problems. Conducted in a geologically classic area where all the major rock types and structures may be studied in a variety of geological situations. Reports, which integrate the geology, surface processes and literature of the studied areas, is required. Recommended to follow the junior year.

**Prerequisite(s):** GEOL 1170, GEOL 1180, GEOL 2750, GEOL 2760, GEOL 3300; GEOL 3450 recommended.

**GEOL 4640 CRITICAL ZONE SCIENCE (4 credits)**

This course examines the Critical Zone (CZ), Earth's permeable layer that extends from the top of vegetation to the bottom of groundwater. The CZ is a constantly evolving layer where rock, soil, water, air, and living organisms interact to regulate the landscape and natural habitats; it also determines the availability of life-sustaining resources, including our food production and water quality. CZ science is an interdisciplinary and international endeavor focused on cross-disciplinary science. In this course, we will focus on using data available from the existing National Science Foundation (NSF)-funded CZ Observatories (CZOs) along with readings, discussions and activities to explore interactions within the CZ. (Cross-listed with GEOG 4640, GEOG 8646)

**Prerequisite(s):** One of the following: GEOL 1170, GEOL 1010, GEOG 1030 or GEOG 1050; one chemistry or physics course recommended; or instructor permission.

**GEOL 4800 INTERNSHIP IN ENVIRONMENTAL/REGIONAL PLANNING/EARTH SCIENCE (3 credits)**

Internship with local agencies or corporations enabling students to gain knowledge and experience in geology, comprehensive regional or environmental planning, or environmental science.

**Prerequisite(s):** Senior, major or area of concentration in Geology or Environmental Science and permission.

**GEOL 4950 SENIOR THESIS (3 credits)**

An independent research project undertaken by all geology majors during their final year. Topics will be selected in consultation with appropriate faculty and researched through field work, laboratory work and/or library sources.

**Prerequisite(s):** Senior, ENGL 1150/ENGL 1154 and ENGL 1160/ENGL 1164

**Distribution:** Writing in the Discipline Single Course