

# **GEOLOGY (GEOL)**

## **GEOL 100 Introduction to Geology**

**Prerequisites:** Credit toward the degree may be earned in only one of GEOL 100 or GEOL 101 or GEOL 101H

**Notes:** Does not fulfill the prerequisite requirement for any course in geology.

**Description:** Background in physical geology for non-majors. Topics include rocks and minerals, surficial processes, plate tectonics, and applied geology.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**ACE:** ACE 4 Science

## **GEOL 101 Dynamic Earth**

**Prerequisites:** Credit toward the degree may be earned in only one of GEOL 100 or GEOL 101 or GEOL 101H

**Notes:** Lab includes field trips.

**Description:** Minerals, rocks, and ores; the surface features and internal character of the earth and the forces that are constantly changing it. Examination of minerals and rocks and investigation of geological processes and their products.

**Credit Hours:** 4

**Max credits per semester:** 4

**Max credits per degree:** 4

**Grading Option:** Graded with Option

**Prerequisite for:** GEOG 308, GEOL 308, NRES 308; GEOL 103; GEOL 200; GEOL 260; GEOL 372; METR 270; PLAS 455, AGRO 855, NRES 455, NRES 855, SOIL 455

**ACE:** ACE 4 Science

**Course and Laboratory Fee:** \$25

## **GEOL 103 Earth Through Time**

**Prerequisites:** GEOL 101

**Description:** An examination of the evolution of life on earth through time in the context of changing continents, oceans, and climate. Lab work includes the study of earth processes affecting the sedimentary rock record and provides an overview of common fossils.

**Credit Hours:** 4

**Max credits per semester:** 4

**Max credits per degree:** 4

**Grading Option:** Graded with Option

**Offered:** SPRING

**ACE:** ACE 4 Science

**Course and Laboratory Fee:** \$30

## **GEOL 105 Fossils and the History of Life**

**Description:** Introduction to the history of life based on the fossil record, evolutionary patterns, and processes.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** FALL/SPR

**ACE:** ACE 4 Science

## **GEOL 106 Environmental Geology**

**Description:** Survey of geologic materials and processes with emphasis on those that influence modern societies' adjustment to our environment.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** GEOL 372

**ACE:** ACE 4 Science

## **GEOL 109 Oceanography**

**Description:** Introduction to physical oceanography, the geologic aspects of biologic oceanography, and human impact on the oceans.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**ACE:** ACE 4 Science

## **GEOL 110 Deadly Planet**

**Description:** Major geological natural hazards that affect human society and the geological processes that are responsible for them, such as earthquakes, tsunamis, volcanoes, landslides, floods, and meteorite impacts.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**ACE:** ACE 4 Science

## **GEOL 120 Geology of National Parks and Monuments**

**Description:** Physical and historical geology of selected United States parklands. Geological and geophysical processes that produced the unique features of the parks. Interpretation of fossils, archaeology and geologic history. Environmental park policy issues involving geosciences.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** SPRING

**ACE:** ACE 4 Science

## **GEOL 125 Frontiers in Antarctic Geosciences**

**Description:** Scientific exploration of the modern environment and geological and climate history of the Antarctic continent and Southern Ocean.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**ACE:** ACE 9 Global/Diversity ACE 4 Science

## **GEOL 200 Mineralogy**

**Prerequisites:** GEOL 101; MATH 102, 103, or a qualifying MPE score for MATH 106; CHEM 109A and CHEM 109L or parallel

**Description:** Crystallography and mineral optics, mineral classes, crystal chemistry, and mineral identification methods. Includes microscope techniques and field methods.

**Credit Hours:** 2

**Max credits per semester:** 2

**Max credits per degree:** 2

**Grading Option:** Graded with Option

**Offered:** FALL/SPR

**Prerequisite for:** GEOL 201

**Course and Laboratory Fee:** \$60

### **GEOL 201 Igneous and Metamorphic Petrology**

**Prerequisites:** GEOL 200

**Description:** Introduction to the petrology of common igneous and metamorphic rocks and their identification, occurrence, and formation. Includes microscope techniques, analytical methods, and phase diagrams.

**Credit Hours:** 2

**Max credits per semester:** 2

**Max credits per degree:** 2

**Grading Option:** Graded with Option

**Prerequisite for:** GEOL 300; GEOL 400; GEOL 410

**Course and Laboratory Fee:** \$50

### **GEOL 260 Geology of the Western USA**

**Prerequisites:** GEOL 101

**Description:** Learn to identify rock types and sedimentary and structural features in the field in the Western United States. Build crucial field skills including the ability to tell a geologic story from a landscape or outcrop.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Grading Option:** Graded

**Offered:** SPRING

**Experiential Learning:** Fieldwork

### **GEOL 291 Special Topics in Geology**

**Description:** Topics vary.

**Credit Hours:** 1-6

**Min credits per semester:** 1

**Max credits per semester:** 6

**Max credits per degree:** 6

**Grading Option:** Graded with Option

### **GEOL 296 Independent Study in Geology**

**Prerequisites:** Permission.

**Description:** Independent study under direction of a faculty member.

**Credit Hours:** 1-3

**Min credits per semester:** 1

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

### **GEOL 300 Sedimentology and Stratigraphy**

**Prerequisites:** GEOL 201

**Description:** Sedimentary rocks and processes, their descriptive parameters, occurrence, origin, and significance in earth history. Stratified rocks in time and space, and methods of correlating geologic units from different localities.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** FALL

**Prerequisite for:** GEOL 301; GEOL 400

**Course and Laboratory Fee:** \$25

### **GEOL 301 Depositional Environments**

**Prerequisites:** GEOL 300

**Description:** Sedimentological facies analysis and recognition of clastic, carbonate, and evaporite depositional systems in the rock record.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** SPRING

**Course and Laboratory Fee:** \$25

### **GEOL 308 Biogeography**

**Crosslisted with:** GEOG 308, NRES 308

**Prerequisites:** GEOG 155 or BIOS 101 and 101L or GEOL 101.

**Notes:** Biogeography is a highly interdisciplinary science, relying heavily on ecology, geological science, and climatology. It is global in scope and offers the latest knowledge in understanding organism distributions, and the factors that determine those distributions.

**Description:** Introduction to the basic concepts of biogeography, the study of distributions of plants and animals, both past and present.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

### **GEOL 361 Soils, Environment and Water Quality**

**Crosslisted with:** PLAS 361, NRES 361, SOIL 361

**Prerequisites:** PLAS/SOIL 153; MATH 102 or 103; two semesters chemistry (CHEM 105A and 105L, CHEM 106A and 106L, CHEM 109A and 109L, CHEM 110A and 110L) and WATS/GEOG/NRES 281

**Description:** Chemical and physical processes that influence the fate and transport of contaminants (inorganic, organic, microbial) in soil-water environments. Extent, fate, mitigation and impact of various sources of pollution. Remedial technologies used for environmental restoration of contaminated environments.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** PLAS 458, AGRO 858, NRES 458, NRES 858, SOIL 458

### **GEOL 372 Water & Earth Connections**

**Prerequisites:** GEOL 101, or GEOL 106, or METR 100, and MATH 106, or instructor permission

**Description:** Quantitative understanding of water-related processes in the earth sciences.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

### **GEOL 400 Structural Geology**

**Prerequisites:** GEOL 201; GEOL 300 or parallel; PHYS 141 or 211.

**Description:** Folding and faulting of rocks, types of texture and rock structure, cleavage, joints, dikes, and unconformities; structural interpretation of geologic maps; plate tectonics, mountain belts, and regional structures.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** FALL

**Prerequisite for:** GEOL 460

**ACE:** ACE 10 Integrated Product

**Course and Laboratory Fee:** \$75

### **GEOL 410 Geochemistry**

**Prerequisites:** MATH 106; GEOL 201.

**Description:** Age of the Earth. Origin of the elements, solar system, oceans, atmosphere, and global geochemical cycles. Radioactive isotope geochemistry, stable isotope geochemistry, and equilibrium relationships.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

### **GEOL 412 Volcanology and Igneous Petrology**

**Crosslisted with:** GEOL 812

**Prerequisites:** GEOL 201; and either CHEM 109A and 109L or CHEM 113A and 113L

**Description:** The study of igneous systems, including an investigation of volcanic processes, mineral equilibria, petrography, and the geochemistry of magmas and minerals.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Course and Laboratory Fee:** \$35

### **GEOL 415 Geochemical Thermodynamics**

**Crosslisted with:** GEOL 815

**Prerequisites:** MATH 107, GEOL 201

**Description:** Exploration of the fundamentals of geochemistry from thermodynamics, including the laws of thermodynamics, multicomponent analysis, extrapolation to temperatures and pressures of interest, nonideal solution behavior, phase diagrams, volatile fugacities, and redox reactions.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** FALL/SPR

### **GEOL 418 Chemistry of Natural Waters**

**Crosslisted with:** GEOL 818, NRES 419, NRES 819

**Prerequisites:** CHEM 109A/L and CHEM 110A/L, CHEM 113A/L and CHEM 114.

**Description:** Principles of water chemistry and their use in precipitation, surface water, and groundwater studies. Groundwater applications used to determine the time and source of groundwater recharge, estimate groundwater residence time, identify aquifer mineralogy, examine the degree of mixing between waters of various sources and evaluate what types of biological and chemical processes have occurred during the water's journey through the aquifer system.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Course and Laboratory Fee:** \$25

### **GEOL 419 Applications of Remote Sensing in Agriculture and Natural Resources**

**Crosslisted with:** PLAS 419, GEOG 419, NRES 420, AGRO 819, GEOG 819, GEOL 819, NRES 820

**Prerequisites:** Junior standing

**Description:** Introduction to the basic methods and practical applications of remote sensing to map, monitor and assess agricultural and natural resources and other environmental changes

**Credit Hours:** 4

**Max credits per semester:** 4

**Max credits per degree:** 4

**Grading Option:** Graded with Option

**Course and Laboratory Fee:** \$35

### **GEOL 423 Quaternary Paleoclimatology and Paleoecology**

**Crosslisted with:** BIOS 423, BIOS 823, GEOL 823

**Prerequisites:** 12 hrs GEOL or BIOS.

**Description:** Analysis and interpretation of the Quaternary period's paleoecological data. Patterns of long-term climate variation. Distribution patterns and responses of organisms and ecosystems to Quaternary environmental change.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

### **GEOL 424 Biogeochemical Cycles**

**Crosslisted with:** BIOS 424, BIOS 824, GEOL 824

**Prerequisites:** CHEM 109A and 109L or CHEM 113A and 113L; 12 hrs GEOL or BIOS.

**Description:** Chemical cycling at or near the earth's surface, emphasizing interactions among the atmosphere, biosphere, geosphere and hydrosphere. Modern processes, the geological record, and human impacts on elemental cycles.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**GEOL 430 Quantitative Methods in Paleontology**

**Crosslisted with:** GEOL 830

**Prerequisites:** GEOL 301.

**Description:** Numerical and statistical analysis of paleontological data including biometry, syn-ecology, and quantitative biostratigraphy.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**GEOL 431 Micro-paleontology**

**Crosslisted with:** GEOL 831

**Prerequisites:** At least one of GEOL 103, GEOL 105, or LIFE 121.

**Description:** Morphology, classification, ecology and geological application of common fossil and extant marine, brackish, and freshwater microfossils.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Course and Laboratory Fee:** \$20

**GEOL 436 Cenozoic Mammal Evolution**

**Crosslisted with:** GEOL 836, NRES 436, NRES 836

**Prerequisites:** Junior or Senior Standing

**Description:** Survey of mammalian evolution with emphasis on the origin, radiation, and phylogenetic relationships of Cenozoic fossil mammals. Overview of climatic and ecological changes affecting mammalian adaptations and hands on experience with fossil specimens.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** SPRING

**GEOL 440 Tectonics**

**Crosslisted with:** GEOL 840

**Prerequisites:** GEOL 400.

**Description:** Theory of plate tectonics; tectonic controls on rock assemblages; interpretation of regional structure and tectonic history; origin and tectonic evolution of terrestrial planets.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Course and Laboratory Fee:** \$10

**GEOL 441 Geophysics**

**Crosslisted with:** GEOL 841

**Prerequisites:** PHYS 141 or PHYS 211

**Description:** Geophysical techniques to study the Earth: seismology, gravity, magnetics and heat flow.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** FALL

**GEOL 442 Environmental Geophysics**

**Crosslisted with:** GEOL 842

**Prerequisites:** MATH 106 or STAT 218; PHYS 141 or PHYS211; GEOL 101 or 106

**Description:** Application of near-surface geophysical methods, namely seismic, ground-penetrating radar, and microgravimetry to groundwater, engineering, environmental, and archaeological investigations.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** FALL

**Experiential Learning:** Case/Project-Based Learning

**GEOL 444 Earth and Environmental Microbiology**

**Crosslisted with:** BIOS 444, BIOS 844, GEOL 844

**Prerequisites:** 3 hours of BIOS or 3 hours of LIFE; 3 hours of CHEM

**Description:** An introduction into the role that microorganisms play and have played in natural and man-made environments. Topics covered include microbial diversity and physiology in soil, sediment, and water; microbes in Earth history; biogeochemical cycling; mineral formation and dissolution; biodegradation and bioremediation; biotechnology.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**GEOL 445 Advanced Geophysics**

**Crosslisted with:** GEOL 845

**Prerequisites:** GEOL 441

**Description:** Integrative analysis of geophysical data (gravity, magnetics, seismic) with geological information (well logs, tectonic history, etc.)

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**GEOL 446 Exploration Geophysics**

**Crosslisted with:** GEOL 846

**Prerequisites:** GEOL 485

**Description:** Geophysical methods used for petroleum exploration: potential fields, seismology, electrical and electromagnetic surveying.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Course and Laboratory Fee:** \$25

**GEOL 451 Invertebrate Paleobiology**

**Crosslisted with:** BIOS 451, BIOS 851, GEOL 851

**Prerequisites:** At least one of: GEOL 103, GEOL 105, LIFE 121

**Description:** Overview of the key traits, relationships and evolutionary dynamics of invertebrate animals over Earth's history, particularly over the Phanerozoic (i.e., the last 540 million years). Emphasis on the use of invertebrate fossil record to test ideas about long term evolutionary patterns as well as learning the histories and basic anatomies of major invertebrate taxa.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** SPRING

**GEOL 453 GIS in Earth and Atmospheric Sciences**

**Crosslisted with:** GEOL 853, METR 453, METR 853

**Prerequisites:** Junior or above standing; and one of the following: GEOL 100 or 101, or METR 100

**Description:** Basic concepts of GIS, hands-on experience with various case studies from geology, meteorology, climatology and environmental applications.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded

**GEOL 455 Computational Methods for Modeling Earth Systems**

**Crosslisted with:** GEOL 855

**Prerequisites:** GEOL 200; MATH 106

**Description:** A practical introduction to modeling and computational techniques that bridges subdisciplines of geology, with a focus on fluid transport modeling.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded

**Offered:** FALL/SPR

**GEOL 457 Ecosystem Ecology**

**Crosslisted with:** BIOS 457, BIOS 857, GEOL 857

**Prerequisites:** BIOS 207 and CHEM 110A and 110L and Senior standing

**Description:** Processes controlling the cycling of energy and elements in ecosystems and how both plant and animal species influence them. Human-influenced global and local changes that alter these cycles and ecosystem functioning.

**Credit Hours:** 4

**Max credits per semester:** 4

**Max credits per degree:** 4

**Grading Option:** Graded with Option

**Prerequisite for:** BSEN 954, NRES 954

**ACE:** ACE 10 Integrated Product

**GEOL 460 Summer Field Course**

**Prerequisites:** GEOL 400.

**Notes:** Students must sign up with the department during the Fall semester prior to the camp.

**Description:** Six weeks advanced study of selected field problems. Conducted in a geologically classic area where all major rock types are studied in a variety of geologic situations.

**Credit Hours:** 6

**Max credits per semester:** 6

**Max credits per degree:** 6

**Grading Option:** Graded with Option

**Offered:** SUMMER

**ACE:** ACE 10 Integrated Product

**Course and Laboratory Fee:** \$100

**Experiential Learning:** Fieldwork

**GEOL 475 Water Quality Strategy**

**Crosslisted with:** NRES 475, NRES 875, SOIL 475, PLAS 475, AGRO 875, CIVE 475, CIVE 875, CRPL 475, CRPL 875, GEOL 875, AGST 475, AGST 875

**Prerequisites:** Senior undergraduate or graduate student status.

**Notes:** Capstone course.

**Description:** Introduces methods to identify, analyze, strategize, justify and develop planning approaches to protect water quality from nonpoint source contamination. Focuses on identifying present water quality issues and situations, investigating adverse impacts on whole systems and subsystems over time, developing effective planning strategies, and assessing strategy effectiveness.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** SPRING

**ACE:** ACE 10 Integrated Product

**GEOL 484 Water Resources Seminar**

**Crosslisted with:** PLAS 484, GEOG 484, NRES 484, NRES 884, AGRO 884, GEOG 884, GEOL 884

**Prerequisites:** Junior or above standing

**Description:** Seminar on current water resources research and issues in Nebraska and the region.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Grading Option:** Graded with Option

**GEOL 488 Groundwater Geology**

**Crosslisted with:** GEOL 888, NRES 488, NRES 888

**Prerequisites:** GEOL 100-level course; MATH 106 or equivalent.

**Description:** Occurrence, movement, and development of water in the geologic environment.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** GEOL 986; NRES 918

**Course and Laboratory Fee:** \$10

**GEOL 491 Special Topics in Geology**

**Crosslisted with:** GEOL 891

**Description:** Topics vary.

**Credit Hours:** 1-6

**Min credits per semester:** 1

**Max credits per semester:** 6

**Max credits per degree:** 6

**Grading Option:** Graded with Option

**GEOL 496 Independent Study in Geology**

**Prerequisites:** Permission.

**Description:** Independent study under direction of a faculty member.

**Credit Hours:** 1-3

**Min credits per semester:** 1

**Max credits per semester:** 3

**Max credits per degree:** 6

**Grading Option:** Graded with Option

**GEOL 497 Economic and Exploration Geology**

**Crosslisted with:** GEOL 897

**Prerequisites:** GEOL 301.

**Notes:** A required parallel course will be indicated by the instructor. Field trips which are required and supported by alumni endowment may be scheduled during semester breaks. Course content will vary on a 3-year rotational basis. Combined lectures, seminars, weekend short courses, and field trips.

**Description:** E.F. Schramm Course in Economic Geology. Aspects of fossil fuel geology and exploration.

**Credit Hours:** 2

**Max credits per semester:** 2

**Max credits per degree:** 6

**Grading Option:** Graded with Option

**GEOL 499 Undergraduate Thesis**

**Prerequisites:** Permission.

**Description:** Independent research leading to a thesis.

**Credit Hours:** 1-3

**Min credits per semester:** 1

**Max credits per semester:** 3

**Max credits per degree:** 6

**Grading Option:** Graded with Option

**GEOL 499H Honors Undergraduate Thesis**

**Prerequisites:** Permission. Credit toward the degree cannot be earned in both GEOL 499 and GEOL 499H.

**Description:** Independent research leading to a thesis.

**Credit Hours:** 1-3

**Min credits per semester:** 1

**Max credits per semester:** 3

**Max credits per degree:** 6

**Grading Option:** Graded with Option