

# GEOLOGY (GEOL)

## GEOL 812 Volcanology and Igneous Petrology

**Crosslisted with:** GEOL 412

**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:** Grade Pass/No Pass Option

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

## GEOL 815 Geochemical Thermodynamics

**Crosslisted with:** GEOL 415

**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:** Grade Pass/No Pass Option

**Offered:** FALL/SPR

## GEOL 816 Isotope Geochemistry

**Prerequisites:** GEOL 410

**Description:** Behavior of stable and radiogenic isotopes in geological and cosmochemical systems. Application of isotope geochemistry to determining the age of rocks, as well as the sources of the chemical components in the rocks.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

## GEOL 818 Chemistry of Natural Waters

**Crosslisted with:** GEOL 418, 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:** Grade Pass/No Pass Option

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

## GEOL 819 Applications of Remote Sensing in Agriculture and Natural Resources

**Crosslisted with:** PLAS 419, GEOG 419, GEOL 419, NRES 420, AGRO 819, GEOG 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:** Grade Pass/No Pass Option

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

## GEOL 823 Quaternary Paleoclimatology and Paleoecology

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

**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:** Grade Pass/No Pass Option

## GEOL 824 Biogeochemical Cycles

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

**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:** Grade Pass/No Pass Option

## GEOL 828 Stratigraphic Architecture and Sequence Stratigraphy

**Prerequisites:** GEOL 310

**Description:** Analysis of stratigraphic stacking patterns in sedimentary basins and sequence stratigraphic methods.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

## GEOL 830 Quantitative Methods in Paleontology

**Crosslisted with:** GEOL 430

**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:** Grade Pass/No Pass Option

**GEOL 831 Micro-paleontology**

**Crosslisted with:** GEOL 431

**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:** Grade Pass/No Pass Option

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

**GEOL 836 Cenozoic Mammal Evolution**

**Crosslisted with:** GEOL 436, 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:** Grade Pass/No Pass Option

**Offered:** SPRING

**GEOL 840 Tectonics**

**Crosslisted with:** GEOL 440

**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:** Grade Pass/No Pass Option

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

**GEOL 841 Geophysics**

**Crosslisted with:** GEOL 441

**Prerequisites:** PHYS 141 or PHYS 211

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

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

**Offered:** FALL

**GEOL 842 Environmental Geophysics**

**Crosslisted with:** GEOL 442

**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:** Grade Pass/No Pass Option

**Offered:** FALL

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

**GEOL 844 Earth and Environmental Microbiology**

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

**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:** Grade Pass/No Pass Option

**GEOL 845 Advanced Geophysics**

**Crosslisted with:** GEOL 445

**Prerequisites:** GEOL 441

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

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

**GEOL 846 Exploration Geophysics**

**Crosslisted with:** GEOL 446

**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:** Grade Pass/No Pass Option

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

**GEOL 851 Invertebrate Paleobiology**

**Crosslisted with:** GEOL 451, BIOS 451, BIOS 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:** Grade Pass/No Pass Option

**Offered:** SPRING

**GEOL 853 GIS in Earth and Atmospheric Sciences**

**Crosslisted with:** GEOL 453, 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 855 Computational Methods for Modeling Earth Systems

**Crosslisted with:** GEOL 455

**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 857 Ecosystem Ecology

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

**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:** Grade Pass/No Pass Option

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

### GEOL 875 Water Quality Strategy

**Crosslisted with:** NRES 475, NRES 875, SOIL 475, PLAS 475, AGRO 875, CIVE 475, CIVE 875, CRPL 475, CRPL 875, GEOL 475, 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:** Grade Pass/No Pass Option

**Offered:** SPRING

### GEOL 884 Water Resources Seminar

**Crosslisted with:** PLAS 484, GEOG 484, GEOL 484, NRES 484, NRES 884, AGRO 884, GEOG 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:** Grade Pass/No Pass Option

### GEOL 888 Groundwater Geology

**Crosslisted with:** GEOL 488, 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:** Grade Pass/No Pass Option

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

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

### GEOL 891 Special Topics in Geology

**Crosslisted with:** GEOL 491

**Description:** Topics vary.

**Credit Hours:** 1-6

**Min credits per semester:** 1

**Max credits per semester:** 6

**Max credits per degree:** 6

**Grading Option:** Grade Pass/No Pass Option

### GEOL 897 Economic and Exploration Geology

**Crosslisted with:** GEOL 497

**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:** Grade Pass/No Pass Option

### GEOL 925 Seminar in Sedimentology

**Credit Hours:** 1-2

**Min credits per semester:** 1

**Max credits per semester:** 2

**Max credits per degree:** 2

**Grading Option:** Grade Pass/No Pass Option

**Course and Laboratory Fee:** \$70

### GEOL 926 Marine Geology and Paleoceanography

**Description:** Geology of the oceanic realm, formation of oceanic crust, circulation, geochemistry, pelagic sediments and their diagenesis, correlation, and oceanic history.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

### GEOL 936 Siliceous Phytoplankton Paleontology

**Description:** Biostratigraphy, paleoecology, and paleobiogeography of fossil diatoms, silicoflagellates and ebridians.

**Credit Hours:** 4

**Max credits per semester:** 4

**Max credits per degree:** 4

**Grading Option:** Grade Pass/No Pass Option

### GEOL 939 Seminar in Paleontology

**Credit Hours:** 1-2

**Min credits per semester:** 1

**Max credits per semester:** 2

**Max credits per degree:** 2

**Grading Option:** Grade Pass/No Pass Option

### GEOL 940 Advanced Structural Geology

**Credit Hours:** 1-24

**Min credits per semester:** 1

**Max credits per semester:** 24

**Max credits per degree:** 24

**Grading Option:** Grade Pass/No Pass Option

**Course and Laboratory Fee:** \$70

**GEOL 945 Seminar in Structural Geology and Tectonics**

**Credit Hours:** 1-2

**Min credits per semester:** 1

**Max credits per semester:** 2

**Max credits per degree:** 2

**Grading Option:** Grade Pass/No Pass Option

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

**GEOL 947 Seminar in Geophysics**

**Description:** Review and discussion of professional research papers in Geophysics.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

**GEOL 957 Modeling Vadose Zone Hydrology**

**Crosslisted with:** AGEN 957, BSEN 957, CIVE 957

**Prerequisites:** MATH 221/821 or equivalent. AGEN/BSEN 350 or NRES 453/853 or equivalent.

**Notes:** Typically offered spring semester in even years.

**Description:** Principles and modeling of fluid flow and solute transport in the vadose zone. Topics include hydraulic properties of variably saturated media, application of Darcy's Law in variably saturated media, hydrologic and transport processes in the vadose zone, and solution of steady and unsteady flow problems using numerical techniques including finite element methods. Contemporary vadose zone models will be applied to engineering flow and transport problems. Review and synthesis of classic and contemporary research literature on vadose zone hydrology will be embedded in the course.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

**Offered:** SPRING

**GEOL 986 Contaminant Hydrogeology**

**Prerequisites:** GEOL 888, MATH 208.

**Description:** Occurrence, behavior and remediation of contamination in geological media. Fundamentals of physical, mathematical, chemical, and engineering processes affecting movement of contaminants in the hydrogeological environment and their applications. Teamwork, projects, seminar presentations, field trips and invited lectures.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

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

**GEOL 988 Introduction to Groundwater Modeling**

**Prerequisites:** GEOL 889, MATH 208 or equivalent, programming language.

**Description:** Application of fundamentals of modeling techniques (analytical, semi-analytical, finite-difference and finite elements) to the solution of hydrogeological problems. Emphasis on development of model concepts for specific groundwater flow and transport conditions, selection of solution methods, including computer software and hardware, performance of computer modeling, and interpretation of results.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option