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 817 Organic Geochemistry
Crosslisted with: GEOL 417
Prerequisites: GEOL 410 and CHEM 251.
Description: Origin, preservation and transport of organic compounds found in the rock record. Applications of organic geochemistry to paleoclimatic and paleoenvironmental interpretations as well as discerning the origins of coal, oil and natural gas.
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, WATS 418
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

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
Notes: GEOG 418/NRES 418 recommended
Description: Introduction to the practical uses of remote electromagnetic sensing in dealing with agricultural and water-resources issues.
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 821 Carbonate Petrology
Crosslisted with: GEOL 421
Prerequisites: GEOL 301.
Notes: Lab focuses on field, petrographic and geochemical methods.
Description: Depositional settings and processes, petrography, geochemistry, diagenesis and geological significance of modern and ancient carbonate rocks and sediments.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

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 paleoclimatological 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

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: $20

GEOL 841 Geophysics
Crosslisted with: GEOL 441
Prerequisites: PHYS 142 or PHYS 212
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: Grade Pass/No Pass Option
Offered: FALL

GEOL 842 Environmental Geophysics I
Crosslisted with: GEOL 442
Prerequisites: MATH 107; PHYS 211; GEOL 101 or 106.
Description: Introduction to the principles of seismic, ground-penetrating radar, and bore-hole geophysical methods and their application to groundwater, engineering, environmental, and archaeological investigations.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Grade Pass/No Pass Option

GEOL 843 Environmental Geophysics II
Crosslisted with: GEOL 443
Prerequisites: MATH 107; PHYS 211; GEOL 101 or 106.
Description: Introduction to principles of magnetic, electromagnetic, resistivity, and gravity methods and their application to ground water, engineering, environmental, and archaeological investigations.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $10

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
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Prerequisites</th>
<th>Crosslisted with</th>
<th>Credit Hours</th>
<th>Offered</th>
<th>Course and Laboratory Fee</th>
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<tbody>
<tr>
<td>GEOL 845</td>
<td>Advanced Geophysics</td>
<td>Geophysical methods used for petroleum exploration; potential fields, seismology, electrical and electromagnetic surveying.</td>
<td>GEOL 485</td>
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<td>GEOL 846</td>
<td>Exploration Geophysics</td>
<td>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.</td>
<td>GEOL 446</td>
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<td>GEOL 850</td>
<td>Surficial Processes and Landscape Evolution</td>
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<td>GEOL 301.</td>
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<td>GEOL 851</td>
<td>Invertebrate Paleobiology</td>
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<td>At least one of: GEOL 103, GEOL 105, LIFE 121</td>
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<td>$35</td>
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<td>GEOL 853</td>
<td>GIS in Earth and Atmospheric Sciences</td>
<td>Basic concepts of GIS, hands-on experience with various case studies from geology, meteorology, climatology and environmental applications.</td>
<td>GEOL 453, METR 453, METR 853</td>
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<td>GEOL 855</td>
<td>Computational Methods for Modeling Earth Systems</td>
<td>A practical introduction to modeling and computational techniques that bridges subdisciplines of geology, with a focus on fluid transport modeling.</td>
<td>GEOL 455</td>
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<td>GEOL 857</td>
<td>Ecosystem Ecology</td>
<td>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.</td>
<td>BIOS 457, BIOS 857, GEOL 457</td>
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<td>GEOL 870</td>
<td>Field Techniques in Hydrogeology</td>
<td>A practical introduction to modeling and computational techniques that bridges subdisciplines of geology, with a focus on fluid transport modeling.</td>
<td>GEOL 470</td>
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<td>GEOL 872</td>
<td>Water in Geosciences</td>
<td>Quantitative approach to water in geological media, earth surface and atmosphere. Understanding and analysis of physical processes involved in groundwater-surface-atmosphere interactions.</td>
<td>GEOL 472</td>
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<td>GEOL 875</td>
<td>Water Quality Strategy</td>
<td>Holistic approach to the selection and analysis of planning strategies for protecting water quality from nonpoint sources of contamination. Introduction to the use of methods of analyzing the impact of strategies on whole systems and subsystems; for selecting strategies; and for evaluating present strategies.</td>
<td>NRES 475, NRES 875, SOIL 475, WATS 475, PLAS 475, AGRO 875, CIVE 475, CIVE 875, CRPL 475, CRPL 875, GEOL 475, AGST 475, AGST 875, POLS 475, POLS 875</td>
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GEOL 880 Economic Geology of the Metals
Crosslisted with: GEOL 480
Prerequisites: GEOL 400; CHEM 114, CHEM 221A & CHEM 221L.
Description: Occurrence and utilization of the metallic ores. Elementary theory of ore genesis.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $10

GEOL 884 Water Resources Seminar
Crosslisted with: PLAS 484, GEOG 484, GEOL 484, NRES 484, WATS 484, NRES 884, AGRO 884, GEOG 884, WATS 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: 2
Grading Option: Grade Pass/No Pass Option

GEOL 885 Fossil Fuel Geology and Exploration
Crosslisted with: GEOL 485
Prerequisites: GEOL 301.
Description: Geology of coal, oil and gas, and methods of exploration.
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 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

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 diagensis, 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**

**Notes:** Can be taken for 1 (no grade, pass/no pass) or for 2 credit hours (grade will be assigned).

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

**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

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**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

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**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

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**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