GEOL 812 Volcanology and Igneous Petrology
Crosslisted with: GEOL 412
Prerequisites: GEOL 210, CHEM 113
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
Format: LEC

GEOL 815 Geochemical Thermodynamics
Notes: This course requires command of material covered in MATH 107 and GEOL 201 or equivalent.
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
Format: LEC

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
Format: LEC

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 palaeoenvironmental 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
Format: LEC

GEOL 818 Chemistry of Natural Waters
Crosslisted with: GEOL 418, NRES 419, NRES 819, WATS 418
Prerequisites: 2 semesters of college chemistry, or CHEM 109 and 110, 113 and 114, or CHEM 111; or permission.
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
Format: LEC

GEOL 818L Chemistry of Natural Waters Laboratory
Crosslisted with: GEOL 418L, NRES 419L, NRES 819L, WATS 418L
Description: Basic laboratory techniques used to perform water analysis including various wet chemical techniques, instrument use (AA, IC, UV-Visible) and computer modeling. Techniques for sample collection and preservation, parameter estimation and chemical analysis.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LAB

GEOL 819 Applications of Remote Sensing in Agriculture and Natural Resources
Crosslisted with: AGRO 419, GEOG 419, GEOL 419, NRES 420, AGRO 819, GEOG 819, NRES 820
Prerequisites: GEOG/NRES 418
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
Format: LEC

GEOL 821 Carbonate Petrology
Crosslisted with: GEOL 421
Prerequisites: GEOL 310.
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
Format: LEC

GEOL 823 Quaternary Paleoclimatology and Paleoecology
Crosslisted with: BIOS 436, BIOS 836, 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
Format: LEC
GEOL 824 Biogeochemical Cycles
Crosslisted with: BIOS 438, BIOS 838, GEOL 424
Prerequisites: CHEM 109 or 113; 12 hrs geology or biological sciences.
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
Format: LEC

GEOL 825 Geostatistics
Crosslisted with: NRES 825
Prerequisites: MATH 106 and STAT 218
Notes: Offered fall semester of odd-numbered calendar years.
Description: Practical methods for solving spatial interpolation and related estimation problems with emphasis on geostatistical methods. Introduction to applied statistical simulation and prediction in geology, hydrogeology and environmental studies.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

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
Format: LEC

GEOL 830 Quantitative Methods in Paleontology
Crosslisted with: GEOL 430
Prerequisites: GEOL 310.
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
Format: LEC

GEOL 831 Micro-paleontology
Crosslisted with: GEOL 431
Prerequisites: GEOL 310.
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
Format: LEC

GEOL 835 Vertebrate Paleontology
Crosslisted with: GEOL 435
Prerequisites: Permission or graduate standing.
Description: Survey of the evolution of the vertebrates, including the geological and biological factors that influence the pattern of evolution, and laboratory study of fossil materials of the major vertebrate groups.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

GEOL 836 Evolution of Cenozoic Mammals
Crosslisted with: GEOL 436, NRES 436, NRES 836
Prerequisites: GEOL 103.
Description: Survey of mammalian evolution with emphasis on the origin, radiation, and phylogenetic relationships of Cenozioc fossil mammals. Overview of climatic and ecological changes affecting mammalian adaptations and hands on experience with specimens.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

GEOL 840 Tectonics
Crosslisted with: GEOL 440
Prerequisites: GEOL 400 or permission
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
Format: LEC

GEOL 842 Environmental Geophysics I
Crosslisted with: GEOL 442
Prerequisites: MATH 107; PHYS 211; GEOL 101 or 106; or equivalent or permission.
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
Format: LEC

GEOL 843 Environmental Geophysics II
Crosslisted with: GEOL 443
Prerequisites: MATH 107; PHYS 211; GEOL 101 or 106; or equivalent or permission.
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
Format: LEC

GEOL 844 Geomicrobiology
Crosslisted with: BIOS 444, BIOS 844, GEOL 444
Prerequisites: 3 hours biological sciences and 3 hours chemistry.
Description: Lectures and discussions of primary literature regarding microorganisms and their role transforming Earth through geologic time.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Crosslisted with</th>
<th>Prerequisites</th>
<th>Description</th>
<th>Credit Hours</th>
<th>Max credits per semester</th>
<th>Max credits per degree</th>
<th>Format</th>
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<tr>
<td>GEOL 845</td>
<td>Advanced Geophysics</td>
<td></td>
<td>GEOL 445</td>
<td>Integrative analysis of geophysical data (gravity, magnetics, seismic) with geological information (well logs, tectonic history, etc.)</td>
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<tr>
<td>GEOL 850</td>
<td>Surficial Processes and Landscape Evolution</td>
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<td>GEOL 450</td>
<td>Fluvial, glacial, eolian, and coastal processes and landforms. Roles of tectonics, climate, and climate change in landscape evolution. Lab stresses description and interpretation of landforms from remotely-sensed, cartographic, and field data.</td>
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<tr>
<td>GEOL 857</td>
<td>Ecosystem Ecology</td>
<td>BIOS 457, BIOS 857, GEOL 457</td>
<td>BIOS 207 and CHEM 110 and Senior standing.</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>
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<td>GEOL 861</td>
<td>Soil Physics</td>
<td>AGRO 461, GEOL 461, NRES 461, SOIL 461, WATS 461, AGRO 861, NRES 861</td>
<td>AGRO/SOIL 153; PHYS 141 or equivalent, one semester of calculus.</td>
<td>Principles of soil physics. Movement of water, air, heat, and solutes in soils. Water retention and movement, including infiltration and field water regime. Movement of chemicals in soils.</td>
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<td>GEOL 865</td>
<td>Soil Geomorphology and Paleopedology</td>
<td>GEOL 465, NRES 465, NRES 865</td>
<td>GEOL 450/850 and NRES 477/877; or permission.</td>
<td>Soils and paleosols as evidence in reconstruction landscape evolution and paleoenvironments. Role of paleosols in stratigraphy.</td>
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<td>GEOL 870</td>
<td>Field Techniques in Hydrogeology</td>
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<td>GEOL 470</td>
<td>Basic techniques, field procedures, instruments, and software for data interpretation, and characterization of groundwater flow and contaminant transport.</td>
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<td>GEOL 872</td>
<td>Water in Geosciences</td>
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<td>GEOL 472</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>
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<td>GEOL 875</td>
<td>Water Quality Strategy</td>
<td>NRES 475, NRES 875, SOCI 475, SOCI 875, SOIL 475, WATS 475, AGRO 475, AGRO 875, CIVE 475, CIVE 875, CRPL 475, CRPL 875, GEOL 475, MSYM 475, MSYM 875, POLS 475, POLS 875</td>
<td>Senior standing or permission.</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>
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<td>GEOL 880</td>
<td>Economic Geology of the Metals</td>
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<td>GEOL 480</td>
<td>Occurrence and utilization of the metallic ores. Elementary theory of ore genesis.</td>
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<td>GEOL 884</td>
<td>Water Resources Seminar</td>
<td>AGRO 484, GEOG 484, GEOL 484, GEOL 484, NRES 484, WATS 484, NRES 884, AGRO 884, GEOG 884, WATS 884</td>
<td>Junior or above standing, or permission.</td>
<td>Seminar on current water resources research and issues in Nebraska and the region.</td>
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GEOL 885 Fossil Fuel Geology and Exploration
Crosslisted with: GEOL 485
Prerequisites: 12 hrs geology.
Description: Geology of coal, oil and gas, and methods of exploration.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

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
Format: LEC

GEOL 918 Seminar in Geochemistry
Description: Seminar in the study of geochemistry. Topics will vary.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Format: LEC

GEOL 925 Seminar in Sedimentology
Credit Hours: 1-2
Min credits per semester: 1
Max credits per semester: 2
Max credits per degree: 2
Format: LEC

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
Format: LEC
GEOL 935 Cenozoic Vertebrate Paleoecology
Prerequisites: GEOL 836
Description: Terrestrial vertebrate history during the Cenozoic Era with emphasis on the fossil record of Great Plains mammalian communities within the last fifteen million years.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Format: LEC

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
Format: LEC

GEOL 937 Mesozoic Calcareous Nannofossil Paleontology
Description: Biostratigraphy, paleoecology, and paleobiogeography of Mesozoic calcareous nannofossils.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

GEOL 938 Cenozoic Calcareous Microfossil Paleontology
Description: Biostratigraphy, paleoecology, and paleobiogeography of Cenozoic calcareous nannofossils.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

GEOL 939 Seminar in Paleontology
Credit Hours: 1-2
Min credits per semester: 1
Max credits per semester: 2
Max credits per degree: 2
Format: LEC

GEOL 940 Advanced Structural Geology
Credit Hours: 1-24
Min credits per semester: 1
Max credits per semester: 24
Max credits per degree: 24
Format: LEC

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
Format: LEC

GEOL 956 Seminar in Quaternary Geology
Credit Hours: 1-2
Min credits per semester: 1
Max credits per semester: 2
Max credits per degree: 2
Format: LEC

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
Format: LEC
Offered: SPRING

GEOL 985 Solute Movement in Soils
Crosslisted with: AGEN 955, AGRO 955, CIVE 955
Prerequisites: MATH 208; AGRO 861 or GEOL 888 or MSYM 852 or CIVE 858
Description: Examination of the theory and experimental evidence available to characterize the movement of chemicals in soil. Both saturated and unsaturated flow conditions examined. Initial presentation of basic theoretical concepts. Remainder of class a discussion of the literature.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

GEOL 986 Contaminant Hydrogeology
Prerequisites: GEOL 888, MATH 208 or equivalent, or permission
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
Format: LEC

GEOL 987 Seminar in Hydrogeology
Credit Hours: 1-2
Min credits per semester: 1
Max credits per semester: 2
Max credits per degree: 2
Format: LEC
GEOL 988 Introduction to Groundwater Modeling

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

**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

**Format:** LEC