# GEOLOGY (GEOL)

**GEOL 812 Volcanology and Igneous Petrology**
**Crosslisted with:** GEOL 412
**Prerequisites:** GEOL 201; and either CHEM 109 or 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
**Grading Option:** Grade Pass/No Pass Option

**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 109 and 110, 113 and 114, or CHEM 111.
**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
**Prerequisite for:** GEOL 418L, GEOL 818L, NRES 419L, NRES 819L, WATS 418L; GEOL 917, NRES 917

**GEOL 818L Chemistry of Natural Waters Laboratory**
**Crosslisted with:** GEOL 418L, NRES 419L, NRES 819L, WATS 418L
**Prerequisites:** CHEM 109 and 110 or CHEM 113 and 114; GEOL 418 or parallel.
**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
**Grading Option:** Grade Pass/No Pass Option

**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
**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
**Groups:** Techniques

**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 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 109 or 113; 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 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
**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:** GEOL 301.
**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 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
**Grading Option:** Grade Pass/No Pass Option

**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 Cenozoic 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
**Grading Option:** Grade Pass/No Pass Option
**Prerequisite for:** GEOL 935

**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

**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

**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 344
**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:** 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

**GEOL 850 Surficial Processes and Landscape Evolution**
**Crosslisted with:** GEOL 450
**Prerequisites:** GEOL 301.
**Description:** 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.
**Credit Hours**: 3
**Max credits per semester:** 3
**Max credits per degree:** 3
**Grading Option:** Grade Pass/No Pass Option
**Prerequisite for:** GEOL 465, GEOL 865, NRES 465, NRES 865

**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
**Groups:** Introductory

**GEOL 857 Ecosystem Ecology**
**Crosslisted with:** BIOS 457, BIOS 857, GEOL 457
**Prerequisites:** BIOS 207 and CHEM 110 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 861 Soil Physics**
**Crosslisted with:** AGRO 461, GEOL 461, NRES 461, SOIL 461, WATS 461, AGRO 861, NRES 861
**Prerequisites:** AGRO/SOIL 153; PHYS 141 or equivalent, one semester of calculus.
**Description:** 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.
**Credit Hours**: 3
**Max credits per semester:** 3
**Max credits per degree:** 3
**Grading Option:** Grade Pass/No Pass Option
**Prerequisite for:** AGEN 955, AGRO 955, CIVE 955, GEOL 985

**GEOL 865 Soil Geomorphology and Paleopedology**
**Crosslisted with:** GEOL 465, NRES 465, NRES 865
**Prerequisites:** GEOL 450/850 and NRES 477/877.
**Description:** Soils and paleosols as evidence in reconstruction landscape evolution and paleoenvironments. Role of paleosols in stratigraphy.
**Credit Hours**: 3
**Max credits per semester:** 3
**Max credits per degree:** 3
**Grading Option:** Grade Pass/No Pass Option

**GEOL 870 Field Techniques in Hydrogeology**
**Crosslisted with:** GEOL 470
**Prerequisites:** GEOL 488/888.
**Description:** Basic techniques, field procedures, instruments, and software for data interpretation, and characterization of groundwater flow and contaminant transport.
**Credit Hours**: 3
**Max credits per semester:** 3
**Max credits per degree:** 3
**Grading Option:** Grade Pass/No Pass Option

**GEOL 872 Water in Geosciences**
**Crosslisted with:** GEOL 472
**Prerequisites:** MATH 106 and 107; PHYS 141; and one of the following: GEOL 101 or 106 or METR 100.
**Description:** Quantitative approach to water in geological media, earth surface and atmosphere. Understanding and analysis of physical processes involved in groundwater-surface-atmosphere interactions.
**Credit Hours**: 3
**Max credits per semester:** 3
**Max credits per degree:** 3
**Grading Option:** Grade Pass/No Pass Option

**GEOL 875 Water Quality Strategy**
**Crosslisted with:** 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
**Prerequisites:** Senior standing.
**Notes:** Capstone course.
**Description:** 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.
**Credit Hours**: 3
**Max credits per semester:** 3
**Max credits per degree:** 3
**Grading Option:** Grade Pass/No Pass Option
**Groups:** American Government&Public Pol

**GEOL 880 Economic Geology of the Metals**
**Crosslisted with:** GEOL 480
**Prerequisites:** GEOL 400; CHEM 114, 221.
**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

**GEOL 884 Water Resources Seminar**
**Crosslisted with:** AGRO 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:** 1
**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

**GEOL 888 Groundwater Geology**
**Crosslisted with:** GEOL 488, NRES 488, NRES 888
**Prerequisites:** GEOL 100-level course; MATH 106 or equivalent.
**Description:** Occurence, 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:** AGEN 955, AGRO 955, CIVE 955, GEOL 985; GEOL 470, GEOL 870; GEOL 889, NRES 887; GEOL 986; NRES 918

**GEOL 889 Hydrogeology**
**Crosslisted with:** NRES 887
**Prerequisites:** GEOL 888/NRES 488 and MATH 208
**Description:** Principles of flow through porous media with emphasis on basic classical solutions, flow-net analysis, and elementary modern numerical solutions that aid in the analysis and development of groundwater supplies.
**Credit Hours**: 3
**Max credits per semester:** 3
**Max credits per degree:** 3
**Grading Option:** Grade Pass/No Pass Option
**Prerequisite for:** GEOL 988; NRES 918

**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 917 Environmental Isotope Hydrology**
**Crosslisted with:** NRES 917
**Prerequisites:** NRES 819.
**Description:** Theory and use of stable, radiogenic and radioactive isotopes in hydrologic studies. Abundance and variation of the stable isotopes of oxygen, hydrogen, carbon, sulphur, chlorine, nitrogen, and strontium. Application of the isotopes to determine water origin, movement, geochemical history, recharge age and residence time, and to delineate contaminant sources and solute migration.
**Credit Hours**: 3
**Max credits per semester:** 3
**Max credits per degree:** 3
**Grading Option:** Grade Pass/No Pass Option

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

**GEOL 919 Seminar in Mineralogy and Petrology**
**Description:** Advanced seminar on the study of mineralogy and petrology. Topics will 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 920 Seminar in Stratigraphy**
**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 921 Sedimentary Petrography and Diagenesis**
**Description:** Study of sedimentary rocks under the microscope, including origin, composition, texture, and diagenesis.
**Credit Hours**: 3
**Max credits per semester:** 3
**Max credits per degree:** 3
**Grading Option:** Graded

**GEOL 922 Seminar in Sedimentary Environments**
**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 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

**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 929 Mesozoic and Cenozoic Stratigraphy**
**Description:** Application of stratigraphic principles and methods to the solution of Mesozoic and Cenozoic problems.
**Credit Hours**: 3
**Max credits per semester:** 3
**Max credits per degree:** 3
**Grading Option:** Grade Pass/No Pass Option

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

**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
**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

**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

**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

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

**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

**GEOL 987 Seminar in Hydrogeology**
**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 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