BOONE PICKENS SCHOOL OF GEOLOGY

Earth is the residence of all life including humanity; therefore, it is essential to develop a better understanding of its composition, internal, and external processes. Earth is an outdoor laboratory filled with opportunities to observe geologic processes in action. By applying knowledge of forces that shape Earth, geoscientists seek to reconstruct the past and anticipate the future. Geoscientists provide information to society for solving problems and establishing policies for resource management, environmental protection, and public health, safety, and welfare.

Geology addresses how Earth's history helps predict future events, how the evolution of life is recorded in rocks and sediments and how erosion and uplift shape the Earth. Human activities, predominantly on or near the surface, have utilized rocks and rock products, mainly petroleum and metals, to contribute to the quality of life. Because the Earth is dynamic —the land surface is constantly changing—knowledge of earthquakes, volcanoes, plate tectonics, floods, and landslides, is critical to minimize human suffering and economic loss. Within geology, specialties such as environmental geoscience, petroleum geology, ground-water geology (hydrogeology), geomorphology (study of surface processes), structural geology, and paleontology (study of fossils), allow geoscientists to develop exciting careers focusing on the sub-disciplines they love.

Geophysics is a discovery science of the earth and other planets using state-of-the-art technology that integrates geology, mathematics, physics, and computer modeling. Geophysicists explore the earth's natural resources such as oil, gas, minerals, and groundwater, and detect earthquakes, cavities, and contamination hazards aiding societal and environmental sustainability. A Bachelor of Science in geophysics prepares students for graduate school as well as prestigious careers in the environmental, energy, and regulatory industries.

The Boone Pickens School of Geology offers traditional academic degree programs for BS, Accelerated M.S., M.S., and Ph.D. students and conducts various campus and community outreach events. Geology and Geophysics majors are provided with a quality education designed to develop leadership skills and enhance employment opportunities. Research areas for the faculty of the Boone Pickens School of Geology include continental tectonics, conventional and unconventional energy resources, environmental and engineering geology and geophysics, carbon sequestration, paleoclimatology, and satellite remote sensing. In these areas, the school has already established a sound infrastructure —appropriate faculty appointments, advanced laboratories and technologies, and a high volume of scholarly productivity. Full-time Geology and Geophysics undergraduates are eligible for departmental scholarships based on academic achievement and financial need. Teaching assistantships, research assistantships, and fellowships are available for qualifying geology graduate students.

Geologists and Geophysicists are employed extensively in applied and pure research topics as well as in teaching. Applied research includes the exploration for, and development of, oil and gas fields, metallic and nonmetallic mineral deposits, and reservoirs of groundwater. The geologists and geophysicists are well prepared to pursue and direct environmental and energy studies. Careers in research may be found with private employers, government agencies, national laboratories, or universities. Teaching positions in geology and geophysics are available at all levels, beginning with secondary education. As with most other sciences, more employment opportunities will be available to students with advanced training and a broad background. In general, careers as teachers in a college or university and in research are open only to those with graduate training.

Courses

GEOL 1003 The Story of Dinosaurs (N)
Description: This course will explore the validity of arguments and/or conclusion in dinosaur research through evaluating the scientific evidence. In this course, students will read, experiment, and evaluate scientific literature surrounding dinosaurs.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology
General Education and other Course Attributes: Natural Science Reasoning

GEOL 1013 Exploring Earth: An Introduction to Geology (LN)
Description: An introductory course for non-science majors which will investigate how chemical, physical and biological processes interact to shape and regulate the Earth's environment. Will build your understanding of how each part of the Earth system – the ocean, atmosphere and interior – work and interact over time.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology
General Education and other Course Attributes: Laboratory-Based Inquiry, Natural Science Reasoning

GEOL 1014 Geology and Human Affairs (LN)
Description: The influence of geology and related earth sciences on the human environment. Energy and material resources, beneficial and hazardous natural processes, and the planetary and biological evolution of earth. Lab investigations environmentally oriented. Lab fees required for online section.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2 Contact: 5
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology
General Education and other Course Attributes: Laboratory-Based Inquiry, Natural Science Reasoning

GEOL 1022 Climate Change and Humanity (N)
Description: Focus on the development of scientific inquiry and critical thinking skills needed to evaluate complex relationships among climate, energy production, and the environment. Students will explore causes and consequences of climate change and consider climate change science from alternative perspectives. Same course as GEOG 1022.
Credit hours: 2
Contact hours: Lecture: 2 Contact: 2
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology
General Education and other Course Attributes: Natural Science Reasoning

GEOL 1114 Physical Geology (LN)
Prerequisites: MATH 1483 or MATH 1513 or higher; or an acceptable math placement score or AP credit (see http://placement.okstate.edu).
Description: Composition and structure of the earth and the modification of its surface by internal and external processes. Mineral resources, sources of energy, and environmental aspects of geology. Recommended introductory course for science majors. Field trip required.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2 Contact: 5
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology
General Education and other Course Attributes: Laboratory-Based Inquiry, Natural Science Reasoning

GEOL 1214 Introductory Geological Processes (LN)
Description: This course is intended to introduce geoscience students to geological processes and foundational concepts within the geosciences, primarily through field-based instruction and exercises, as well as introducing students to the geology of Oklahoma. Field trips required.
Credit hours: 4
Contact hours: Lecture: 1 Contact: 4 Other: 3
Levels: Undergraduate
Schedule types: Independent Study, Lecture, Combined lecture & IS
Department/School: Geology
General Education and other Course Attributes: Laboratory-Based Inquiry, Natural Science Reasoning

GEOL 1224 Evolution of the Earth (LN)
Prerequisites: High school biology and chemistry recommended.
Description: A survey of the physical and biological history of the Earth from the coalescence of the solar system to the present. Field trips required.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2 Contact: 5
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology
General Education and other Course Attributes: Laboratory-Based Inquiry, Natural Science Reasoning

GEOL 2013 Geology of the National Parks (N)
Description: The geologic characteristics of national parks and scenic regions in North America and throughout the world. Intended for non-majors. Previously offered as GEOL 3043.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology
General Education and other Course Attributes: Natural Science Reasoning

GEOL 2030 Geologic Field Experience
Description: One to three weeks of required field study at sites of geological interest and significance. Field trip charges apply. Offered for variable credit, 1-3 credit hours, maximum of 6 credit hours.
Credit hours: 1-3
Contact hours: Contact: 1-3 Other: 1-3
Levels: Undergraduate
Schedule types: Independent Study
Department/School: Geology

GEOL 2043 Water on Earth
Description: The science of water, including surface water, ground water, water quality, pollution, and legal issues. Interrelations between the sciences and humanities.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 2103 Fundamentals of Geophysics
Prerequisites: Minimum grade of "C" in: (GEOL 1014 or GEOL 1114 or GEOL 1214) and (PHYS 1114 or PHYS 2014 or acceptable AP credit).
Description: Course will introduce students to the basic concepts of geophysics. Students will gain theoretical and field experience with multiple geophysical techniques, such as: gravity, magnetic, seismic reflection/refraction, electrical resistivity, induced polarization, self-potential, ground penetrating radar and radiometrics and their applications in oil and gas, minerals, groundwater, and the environment. Field trip required.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 2254 Practical Mineralogy
Prerequisites: GEOL 1014 or GEOL 1114 and CHEM 1314 or CHEM 1414 completed with a grade of "C" or higher.
Description: Hand-specimen identification of minerals using physical and chemical properties. Introductory optical identification of common rock forming minerals. Society's utilization of mineral resources. Field trips required. May not be used for degree credit with GEOL 2464.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2 Contact: 5
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 2364 Igneous and Metamorphic Petrology
Prerequisites: GEOL 2254 completed with a grade of "C" or higher.
Description: Origin, occurrence and classification of igneous and metamorphic rocks; hand-specimen and thin section identification. Optional field trip. May not be used for degree credit with GEOL 2464.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 3 Contact: 6
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 2403 Chemistry of Earth Systems
Prerequisites: Minimum grade of "C" in (GEOL 1014 or GEOL 1114 or GEOL 1214) and (CHEM 1314 or CHEM 1414).
Description: This course will teach the basics of geochemistry as applied to Earth Systems, including topics and concerns related to the atmosphere, geosphere, biosphere, hydrosphere, and anthroposphere. Basic lab and field skills will also be introduced, including fundamentals of environmental measurement practices, geochemical instrumentation, and basic water and sediment sampling techniques.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 2443 Environmental Geology and Human Health (N)
Description: This course explores the connections between human health and environmental geological processes. Key concepts in geology are introduced as well as the pathways through which natural systems affect human health. Topics of interest will include exposures to asbestos, dust and aerosols, coal, and mercury. Course recommended for anyone with an interest in environmental or public health or for those just curious to know more about how the environment affects our health.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology
General Education and other Course Attributes: Natural Science Reasoning

GEOL 2464 Rocks and Minerals
Prerequisites: Minimum grade of "C" in (GEOL 1014 or GEOL 1114 or GEOL 1214) and (CHEM 1314 or CHEM 1414 or acceptable AP credit).
Description: Origin, occurrence and classification of igneous, sedimentary and metamorphic rocks and minerals; hand-specimen and thin section identification, including optical microscopy. Field trip required. May not be used for degree credit with GEOL 2254 and GEOL 2364.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2 Contact: 5
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology
Additional Fees: GEOL 2464 Field Trip fee of $75 applies.

GEOL 2773 Introduction to Planetary Geology (N)
Description: Introduction to the geology of terrestrial planets and moons, exploring volcanism, plate tectonics, atmospheres, and planetary formation, as well as how meteorites and asteroids give insight into the formation of planetary systems.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology
General Education and other Course Attributes: Natural Science Reasoning

GEOL 2890 Honors Experience in Geology
Prerequisites: Honors Program participation and concurrent enrollment in designated course(s).
Description: A supplemental Honors experience in Geology to partner concurrently with designated lower-division GEOL course(s). This course adds a different intellectual dimension to designated course(s). Offered for fixed credit, 1 credit hour.
Credit hours: 1
Contact hours: Lecture: 1 Contact: 1
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology
General Education and other Course Attributes: Honors Credit

GEOL 2990 Special Topics in Earth Science
Description: Selected topics in Geoscience presented in lecture or seminar format. Offered for variable credit, 1-3 credit hours, maximum of 6 credit hours.
Credit hours: 1-3
Contact hours: Lecture: 1-3 Contact: 1-3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 3014 Structural Geology
Prerequisites: Minimum grade of "C" in: GEOL 2464 and (PHYS 1114 or PHYS 2014 or acceptable AP credit).
Description: Behavior of earth materials during various deformational processes and analysis of the resulting structural features such as folds, faults and fractures.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 3 Contact: 6
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology
Additional Fees: Geology Field Trip fee of $40 applies.

GEOL 3034 Principles of Stratigraphy and Sedimentology
Prerequisites: GEOL 1224 and GEOL 2464 each with a grade of "C" or higher.
Description: Principles of stratigraphy and their applications. Survey of sedimentary rock types, principles of description and classification, origin of sedimentary deposits, analysis of stratigraphic sequences. Topics include depositional systems; litho- and biostratigraphy; geochronology and chronostratigraphy; magnetic, seismic, and sequence stratigraphy; tectonic vs. climatic controls. Field work required. Previously offered as GEOL 3033.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 3 Contact: 6
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology
Additional Fees: Geology Field Trip fee of $85 applies.

GEOL 3073 Geomorphology
Prerequisites: GEOL 1014 or GEOL 1114 or GEOL 1214 or GEOG 1014.
Description: This course will outline key concepts in geomorphology including how different geological processes have shaped and are shaping the surface of the Earth. Summary of different geomorphological research methods. Discussion on how exogenic processes such water, glacier and wind weathering produce different landscapes. Discussion on how endogenic processes such as volcanism and tectonism contributes to geomorphological changes. Discussion of how geomorphological changes affect the climate. May not be used for degree credit with GEOL 5073.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 3103 Paleontology
Description: Basic principles of paleontology involving invertebrates, vertebrates and plants. Course will explore the mechanisms and manifestations of evolution in the fossil record, learn key aspects of fossilized organism identification, and assess paleontology interpretations through hands-on experiential learning exercises. Field trips required.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 3413 Petroleum Geology for Engineers
Prerequisites: CHEM 1314 or CHEM 1414 with a grade of "C" or better.
Description: Examination of the fundamental concepts of petroleum geology with an emphasis on applications to drilling and reservoir engineering. Topics include reservoir architecture, traps and seals, the subsurface environment, wireline logs, geophysics and depositional systems. Field trip required. No degree credit for geology majors.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology
Additional Fees: GEOL Course Field Trip fee of $30 applies.

GEOL 3503 Environmental Geology (N)
Prerequisites: GEOL 1014 or GEOL 1114 or GEOL 1214 or consent of instructor.
Description: Application of geologic principles to environmental issues, including human use of the surface and subsurface of the earth and human interaction with extreme natural events such as earthquakes, floods and landslides. Field trip is required.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology
General Education and other Course Attributes: Natural Science Reasoning
Additional Fees: Geology Field Trip fee of $38 applies.

GEOL 3513 Earthquakes, Volcanoes, and Disasters (N)
Description: An examination of the causes and effects of natural disasters related to earthquakes, volcanic activity, severe weather, flooding and other natural disasters. The course also examines the effects of these natural hazards on societies and approaches to mitigate the associated risks.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology
General Education and other Course Attributes: Natural Science Reasoning

GEOL 3546 Field Geology
Prerequisites: Minimum grade of "C" in GEOL 3014 and GEOL 3034.
Description: Five weeks of field methods in geology. Required of all geology majors. Transportation and room and board fees required.
Credit hours: 6
Contact hours: Lab: 12 Contact: 12
Levels: Undergraduate
Schedule types: Lab
Department/School: Geology

GEOL 3890 Advanced Honors Experience in Geology
Prerequisites: Honors Program participation and concurrent enrollment in designated course(s).
Description: A supplemental Honors experience in Geology to partner concurrently with designated upper-division GEOL course(s). This course adds a different intellectual dimension to designated course(s). Offered for fixed credit, 1 credit hour, maximum of 8 credit hours.
Credit hours: 1
Contact hours: Lecture: 1 Contact: 1
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology
General Education and other Course Attributes: Honors Credit

GEOL 4023 Petroleum Geology
Prerequisites: GEOL 3014 and GEOL 3034.
Description: Origin, migration and accumulation of petroleum, requirements for source rock, reservoir rock and traps. Structure and stratigraphy of selected oil fields. Field trips required. May not be used for degree credit with GEOL 5023.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4030 Geologic Field Investigation
Prerequisites: GEOL 1013, GEOL 1014, GEOL 1114 or GEOL 1224.
Description: One to three weeks of required field study at sites of geological interest and significance. Field trip charges apply. Does not substitute for GEOL 3546. Offered for variable credit, 1-3 credit hours, maximum of 6 credit hours.
Credit hours: 1-3
Contact hours: Lecture: 1-3 Contact: 1-3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4103 Introduction to Geophysical Exploration
Prerequisites: MATH 2153 and a "C" or better in PHYS 1214 or PHYS 2114 or acceptable AP credit.
Description: An overview of geophysical methods and their applications to exploration, environmental and engineering problems. Seismic reflection and refraction methods, gravity, magnetic, resistivity and electromagnetic methods. A field trip required. May not be used for degree credit with GEOL 5103.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 4113 Seismic Interpretation
Prerequisites: Minimum grade of "C" in (GEOL 2103 or GEOL 4443) and MATH 2153 and (PHYS 1214 or PHYS 2114).
Description: Examination of the reflection seismic interpretation methods with emphasis on the oil and gas industry. Both structural and stratigraphic methods. Hands-on interpretation using a standard industry software package. May not be used for degree credit with GEOL 5213.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4213 Plate Tectonics
Prerequisites: GEOL 3014 or concurrent enrollment.
Description: Earth's evolution within the framework of plate tectonics. Examination of structural associations in relation to tectonic plate boundaries. Mechanisms for plate tectonics and implication for resources and the environment. May not be used for degree credit with GEOL 6213.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4300 Geology Colloquium
Prerequisites: Geology majors only.
Description: Discussion of selected topics in the geological sciences with emphasis on professional presentation practices. Offered for fixed credit, 1 credit hour, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Contact: 1 Other: 1
Levels: Undergraduate
Schedule types: Independent Study
Department/School: Geology

GEOL 4303 Geophysical Field Methods
Prerequisites: GEOL 4103.
Description: Hands-on field investigations using the different geophysical surveying methods including electrical resistivity/induced polarization, self potential, electromagnetic, ground penetrating radar, gravity, magnetic, and seismic reflection and refraction. Instrumentation, field data acquisition, and interpretation will be emphasized. Several field trips and field projects required.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 4313 Introduction to Well Log Analysis
Prerequisites: GEOL 3034 with a grade of C or better.
Description: Introduction for undergraduate Geology majors to basic properties of wireline well logs that are useful for those interested in the petroleum industry, subsurface environmental issues, ground water and geothermal energy. This course covers use of well logs to identify lithology, influence of borehole fluids, porosity and permeability on well log properties. Some exercises involve concurrent interpretation of well logs and core samples. Course includes lectures, in-class exercises, homework, and exams. No credit for students who have completed GEOL 4323 or GEOL 5353.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4323 Applied Well Log Analysis for Engineers
Prerequisites: GEOL 3413 with a grade of "C" or higher.
Description: This is a core course for the Minor in Petroleum Engineering. Course material builds on information to prerequisite course Geology 3413. This course covers geologic interpretation of reservoir characteristics based on a variety of well logs; quantitative determination of porosity and permeability, reservoir fluids and how they influence well log properties, calculation of water saturation, introduction to unconventional reservoirs, drilling and logging in lateral holes. May not be used for degree credit with GEOL 4313 or GEOL 5353.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4343 Advanced Petrophysics
Prerequisites: Minimum grade of "C" in PHYS 2014.
Description: Provides theoretical background on physical, chemical, and electrical principles involved in routine core analysis (RCA) and special core analysis (SCAL) generic data acquisition, as well as practical experience in applying computational methods to infer petrophysical properties of rocks from RCA and SCAL data. May not be used for degree credit with GEOL 5343.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4403 Environmental Geochemistry
Prerequisites: GEOL 2403 or (GEOL 1014 or GEOL 1114 and CHEM 1515 or concurrent enrollment).
Description: This course is designed to help students comprehend the major chemical components of natural environments and to apply fundamental principles to understand the main controls on the chemistry of pristine and polluted soil, surface, and ground water environments. May not be used for degree credit with GEOL 5403.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 4423 Groundwater Geochemistry
Prerequisites: Minimum grade of "C" in CHEM 1314 and MATH 2144.
Description: Provides, theoretical background to apply geochemical principles to understand and solve groundwater quality problems, as well as practical experience in applying computational methodologies and tools to predict the response of groundwater systems to natural and anthropogenic disturbances. May not be used for degree credit with GEOL 5423.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4433 Applied Geostatistics
Prerequisites: MATH 2144 with a grade of "C" or higher.
Description: Application of geostatistical principles and tools to solve geology problems associated with the uncertainty and spatial variability of geological data. The focus is on petroleum and hydrological systems. May not be used for degree credit with GEOL 5333.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4443 Environmental Geophysics
Prerequisites: A minimum grade of "C" in MATH 2144 and (PHYS 1114 or PHYS 2014 or GEOL 2103).
Description: This course addresses environmental and engineering geophysical applications to geological characterization in (1) groundwater, aquifer delineation and contaminant migration, (2) slope stability and engineering site characterization, (3) detection of abandoned landfills, underground storage tanks, UXO, (4) earthquake, sinkholes, and land subsidence hazards, and/or (5) non-invasive archeological site assessment. Students will gain hands-on experiences in both collecting geophysical data in the field and processing real field data in the lab. Field trips required. May not be used for degree credit with GEOL 5443.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 4453 Hydrogeology
Description: The water cycle and ground-water systems as well as general problems related to ground-water occurrence, quantity, quality and pollution. Field trip required.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology
Additional Fees: Geology Field Trip fee of $75 applies.

GEOL 4463 Physical Hydrogeology
Prerequisites: Completion of PHYS 1114 or PHYS 2014; GEOL 3503 recommended.
Description: Physical ground-water systems. Realistic problems to acquaint students with ground-water occurrence and movement. Geologic, geophysical, hydraulic testing and modeling techniques used to define an actual ground-water system. Ground-water regulations. Field trips required.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4503 Introduction to Oceanography (N)
Prerequisites: College-level chemistry recommended.
Description: Oceanography is an interdisciplinary field incorporating geology, physics, chemistry, and biology. This class will introduce students to oceanic and sedimentary processes, including plate tectonics, oceanic circulation, seawater chemistry, beaches and coastlines, benthic/pelagic sea life, and environmental concerns. Students will also discuss social, political, and economic topics that relate to the ocean.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology
General Education and other Course Attributes: Natural Science Reasoning

GEOL 4513 Marine Geology
Prerequisites: Minimum grade of "C" in: GEOL 1014 or GEOL 1114 or GEOL 1214 or GEOL 4503.
Description: Comprehensive examination of the geology of the ocean basins. Topics include techniques of data collection and interpretation; shoreline, shelf and deep ocean processes; physical oceanography; origin and distribution of marine sediments; paleoceanography; marine mineral resources; marine tectonics and ocean history. May not be used for degree credit with GEOL 5513.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4543 Introduction to Exploration Seismology
Prerequisites: Minimum grade of "C" or better in (GEOL 2103 or GEOL 4443) and MATH 2153 and (PHYS 1214 or PHYS 2114).
Description: Introduction to theory, techniques, and application of seismic to field of hydrocarbon, groundwater, and minerals exploration. Review of fundamentals of wave propagation, historical development of the science, and current literature on application and instrumentation. May not be used for degree credit with GEOL 5543.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4573 Marine Biogeochemical Cycles
Prerequisites: GEOL 3034 with a grade of "C" or better and GEOL 4403 or concurrent enrollment.
Description: Analysis of the interactions between geological processes, biological activity, and chemical cycling for a range of elements. Limited discussion of atmospheric, terrestrial, and freshwater systems as they impact the oceans will also be discussed. Includes discussions of changes in elemental cycles through Earth's history and comparison to present-day patterns. May not be used for degree credit with GEOL 5573.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4583 Environmental Data Analytics
Prerequisites: Minimum grade of "C" in MATH 2144.
Description: Provides theoretical background and practical experience in extracting meaning from complex and heterogeneous environmental data sources to understand and manage the natural environment (geosphere, hydrosphere, biosphere, and atmosphere). May not be used for degree credit with GEOL 5583.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4613 Magmatism and Metamorphism
Prerequisites: GEOL 2464.
Description: Exploration of the processes and environments in which magmatic and metamorphic rocks form, using aspects of mineralogy, petrology, geochemistry and plate tectonics. Will include lab and field examination of rocks, use of phase diagrams, thermodynamics and geochemical data. Field Trip required.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 4643 Seismic Data Processing
Prerequisites: MATH 2144 and (PHYS 1114 or PHYS 2014) strongly recommended.
Description: Theoretical background and practical training in the processing of seismic reflection and refraction data for petroleum, environmental, and engineering applications. Hands-on digital data processing using standard industry software. Topics to be covered include digital filtering, statics corrections, velocity analysis, deconvolution, stacking, and migration. May not be used for degree credit with GEOL 5643.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4673 Critical Earth Materials
Prerequisites: GEOL 2464.
Description: The distribution, geological setting and genesis of metalliferous and non-metalliferous mineral deposits of economic value. Factors controlling the formation of these deposits and the linkages with many other geologic processes covered in other courses are explored. Discussion of geopolitical considerations to the exploration and production of critical earth materials.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 4753 Volcanology
Prerequisites: GEOL 2464 completed with a grade of "C" or higher.
Description: Examination of volcanic processes, products, and structures on Earth and other terrestrial bodies. Optional field trip. May not be used for degree credit with GEOL 5753.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 4773 Planetary Geology (N)
Prerequisites: GEOL 1114 (required) and GEOL 3073 (recommended).
Description: Geology of planets and planetary bodies, including geomorphology, tectonics, geochemistry, and geophysics; perspectives on exploration; and life in the universe.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology
General Education and other Course Attributes: Natural Science Reasoning

GEOL 4981 Geoscience Internship
Prerequisites: Consent of instructor.
Description: Student participation in a research project during an internship in a Geoscience-related professional work setting. Graded on a pass/fail basis.
Credit hours: 1
Contact hours: Contact: 1 Other: 1
Levels: Undergraduate
Schedule types: Independent Study
Department/School: Geology

GEOL 4990 Special Problems in Earth Science
Prerequisites: Permission of instructor.
Description: Individually designed study projects involving assigned reading, library work, field work, laboratory work or a combination of these. Field trips may be required. Offered for variable credit, 1-3 credit hours, maximum of 9 credit hours.
Credit hours: 1-3
Contact hours: Contact: 1-3 Other: 1-3
Levels: Undergraduate
Schedule types: Independent Study
Department/School: Geology

GEOL 4993 Senior Honors Thesis
Prerequisites: Permission of instructor.
Description: A guided reading and research program ending with a thesis under direction of a senior faculty member, with a second faculty reader and oral examination.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology

GEOL 5000 Master's Thesis
Prerequisites: Approval of graduate committee.
Description: Work toward master's thesis in geology. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.
Credit hours: 1-6
Contact hours: Contact: 1-6 Other: 1-6
Levels: Graduate
Schedule types: Independent Study
Department/School: Geology

GEOL 5023 Petroleum Geology
Prerequisites: GEOL 3014 and GEOL 3034.
Description: Origin, migration and accumulation of petroleum, requirements for source rock, reservoir rock and traps. Structure and stratigraphy of selected oil fields. Field trips required. May not be used for degree credit with GEOL 4023.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5030 Geologic Field Investigation
Description: One to three weeks of required field study at sites of geological interest and significance. Emphasis will be placed on applicability to graduate research. Field trip charges apply. Offered for variable credit, 1-3 credit hours, maximum of 6 credit hours.
Credit hours: 1-3
Contact hours: Lecture: 1-3 Contact: 1-3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5073 Geomorphology
Description: This course will outline key concepts in geomorphology including how different geological processes have shaped and are shaping the surface of the Earth. Summary of different geomorphological research methods. Discussion on how exogenic processes such as water, glacier and wind weathering produce different landscapes. Discussion on how endogenic processes such as volcanism and tectonism contributes to geomorphological changes. Discussion of how geomorphological changes affect the climate. No credit for students with credit in GEOL 3073.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5093 Quaternary Geology and Geochronology
Prerequisites: GEOL 3034; MATH 1715 or equivalent; PHYS 2014 and PHYS 2114 or equivalent. All with a grade of "C" or higher.
Description: Examination of the causes and effects of climate change during the ice ages. Survey of dating methods applicable to the Quaternary, including radiocarbon and optical luminescence. Topics include the use of oxygen isotope proxy records, paleomagnetism, cosmogenic nuclides, isostasy and post-glacial rebound, causes of sea-level change, and ice age history.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5100 Problems in Hydrogeology
Prerequisites: GEOL 4453.
Description: Advanced problems in hydrogeology with emphasis on quantitative methods. Field trips may be required. Offered for variable credit, 1-4 credit hours, maximum of 8 credit hours.
Credit hours: 1-4
Contact hours: Contact: 1-4 Other: 1-4
Levels: Graduate
Schedule types: Independent Study
Department/School: Geology

GEOL 5103 Introduction to Geophysical Exploration
Prerequisites: MATH 2153 and a "C" or better in PHYS 1214 or PHYS 2114 or acceptable AP credit.
Description: An overview of geophysical methods and their applications to exploration, environmental and engineering problems. Seismic reflection and refraction methods, gravity, magnetic, resistivity and electromagnetic methods. Field trip required. May not be used for degree credit with GEOL 4103.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 5133 Structural Styles in Oil and Gas Exploration
Prerequisites: GEOL 3014 with a grade of "C" or higher.
Description: The theoretical, experimental and descriptive approach to structural styles formed by different tectonic stresses (i.e. extensional, contractional, strike-slip and salt tectonics) and their importance in oil and gas exploration. Course previously offered as GEOL 5203.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5143 Geological Remote Sensing
Prerequisites: GEOL 1013 or GEOL 1114 and PHYS 1114 or PHYS 2014 each with a minimum grade of "C".
Description: Many applications of remote sensing exist for geological and environmental issues, and this course introduces the techniques and processes including digital signal processing, statistical data extraction, image enhancement and classification. Students will experiment with different techniques and formulate a research project that can be answered using the techniques.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 5183 Paleontology and Paleoceanographic Reconstruction
Prerequisites: Graduate standing or permission of instructor.
Description: This course examines invertebrates, the process of fossilization, taphonomy, and fossil uses in paleontologic reconstructions and biostratigraphy. Students are instructed and expected to complete various sample preparation techniques used in fossil examination. This course has a lecture and lab component. Students in this course should have a basic understanding of biology and evolution. Major ideas and background information will be provided in this course so anyone interested is welcome.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 5213 Seismic Interpretation
Description: Examination of reflection seismic interpretation methods with emphasis on the oil and gas industry. Both structural and stratigraphic methods. Hands-on interpretation using a standard industry software package. Previously offered as GEOL 4203. No credit for students with credit in GEOL 4113.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5223 Advanced Methods in Structural Geology
Prerequisites: GEOL 3014.
Description: Techniques in modern structural geology are changing fast. Students in this course will learn to use cutting-edge techniques in structural analysis to solve problems in the geosciences. At the end of this course, you will have collected structural data using a digital data system, analyzed geodetic data to calculate strain, use data collected from uncrewed aerial vehicles to create digital elevation models and characterize fractures, and conduct traditional fracture analyses from outcrop data. Field trips required.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5233 Trace Element Geochemistry
Prerequisites: One year of chemistry and GEOL 4403 or equivalent and GEOL 3034 or equivalent.
Description: Examination of the behavior of various trace elements in aqueous and sedimentary environments. Availability and mobility of trace elements, characterization of geochemical environments, and application to geologic problems.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 5243 Research Methods and Techniques in Geosciences
Description: Application of the scientific method to geosciences research; introduction to library and internet searches; writing competitive research proposals; managing research activities; and disseminating research results.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5253 Petrology and Diagenesis of Clastic Rocks
Prerequisites: GEOL 3034.
Description: Examination of petrology and depositional facies of sandstones and shales. Identification of detrital and diagenetic constituents and determination of paragenetic sequence of diagenetic events. The effect of burial and thermal history on reservoir quality. Field trips required.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5273 Depositional Systems
Prerequisites: GEOL 3034, GEOL 3546.
Description: Examination of the processes within depositional environments and the facies they form. Focus on the environmental interpretation of rocks, cores and seismic profiles based on their composition, texture, character, stacking pattern and sedimentary structures. Emphasis on clastic systems. Field trips required.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5283 Subsurface Geologic Methods
Prerequisites: GEOL 3014, GEOL 3034.
Description: Use of subsurface geologic information from cores and well logs to prepare maps and identify oil and gas prospects. Field trips required.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 5300 Geology Colloquium
Prerequisites: Graduate standing.
Description: Discussion of selected topics in the geological sciences with emphasis on professional presentation practices. Offered for fixed 1 credit hour, maximum of 2 credit hours.
Credit hours: 1
Contact hours: Contact: 1 Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Geology

GEOL 5313 Plate Tectonics
Prerequisites: GEOL 3014 with a grade of "C" or higher.
Description: Study of the Earth's past and present tectonic environments within the framework of plate tectonics. Systematic examination of structural associations in relation to their spatial distributions around and within plate boundaries. Outlining the temporal evolution of the crust. Discussion on mechanisms for plate tectonics. Implication of plate tectonics in terms of resources and the environment. May not be used for degree credit with GEOL 4213.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5333 Applied Geostatistics
Prerequisites: MATH 2144 with a grade of "C" or higher.
Description: Application of geostatistical principles and tools to solve geology problems associated with the uncertainty and spatial variability of geological data. The focus is on petroleum and hydrological systems. May not be used for degree credit with GEOL 4433.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5343 Advanced Petrophysics
Prerequisites: Minimum grade of "C" in PHYS 2014.
Description: Provides theoretical background on physical, chemical, and electrical principles involved in routine core analysis (RCA) and special core analysis (SCAL) generic data acquisition, as well as practical experience in applying computational methods to infer petrophysical properties of rocks from RCA and SCAL data. May not be used for degree credit with GEOL 4343.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5353 Advanced Well Log Analysis
Prerequisites: GEOL 3034 or consent of instructor.
Description: This course is for geology graduate students interested in the petroleum and environmental industries, geothermal energy and evaluating the subsurface environment using wireline logs. This course will focus on the geologic interpretation of a variety of well logs, as well as quantitative methods to determine porosity and permeability in aquifers and reservoirs, how reservoir fluids influence well log properties, calculating water saturation, and an introduction to unconventional reservoirs. Graduate students are given advanced homework exercises including interpretation of structure, selection of best logging technique, mineral identification, and fractured rock identification. Some exercises involve concurrent interpretation of well logs and core samples. No credit for students with credit in GEOL 4313 or GEOL 4323.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5363 Carbonate Depositional Systems
Prerequisites: GEOL 3034 with a grade of "C" or higher.
Description: Survey course of the main types of carbonate sediments and depositional environments.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology
Additional Fees: Geology Consummable Material fee of $35 and Geology Field Trip fee of $242 apply.

GEOL 5383 Sequence Stratigraphy
Prerequisites: GEOL 3034.
Description: Principles of sequence stratigraphy including carbonate and siliciclastic dominated intracratonic basins. Integration of surface and subsurface data in projects. Field trips required.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5393 Stratigraphy of the Midcontinent
Prerequisites: GEOL 3034 with a grade of "C" or higher.
Description: This course will examine Paleozoic stratigraphy of the North American Midcontinent consisting of Texas, Oklahoma, Kansas, Nebraska, Missouri, and northwestern Arkansas. The course will consist of lectures, student presentations, and extensive field work that will serve to familiarize the students with the surface and subsurface relationships of geologic formation and their potential for commercial exploitation for oil and gas resources.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 3 Contact: 5
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 5403 Environmental Geochemistry
Prerequisites: Graduate Standing required.
Description: This course is designed to help students comprehend the major chemical components of natural environments and to apply fundamental principles to understand the main controls on the chemistry of pristine and polluted soil, surface, and ground water environments. May not be used for degree credit with GEOL 4403.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 5413 Applied Petroleum Geology for Engineers
Description: This course introduces graduate level engineering students to the fundamental concepts of geologic science with emphasis on application to reservoir evaluation, drilling and production of hydrocarbon accumulation. Weekly labs provide hands-on exercises of techniques used for reservoir evaluation. A term project allows graduate students to synthesize concepts from lectures and techniques learned in lab, to evaluate the economic potential of an oil field and prepare a professional presentation. May not be used for degree credit with GEOL 3413.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 5423 Groundwater Geochemistry
Prerequisites: CHEM 1314 and MATH 2144.
Description: Provides, theoretical background to apply geochemical principles to understand and solve groundwater quality problems, as well as practical experience in applying computational methodologies and tools to predict the response of groundwater systems to natural and anthropogenic disturbances. May not be used for degree credit with GEOL 4423.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5433 Isotope Geochemistry
Description: Introduction to the basic principles of stable isotope geochemistry. Study of the production, distribution, and use of naturally occurring and anthropogenically introduced stable isotopes in the earth's near surface environment with applications to hydrology, biogeochemistry, global change and petroleum systems.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 5443 Environmental Geophysics
Description: This course addresses environmental and engineering geophysical applications to geological characterization in (1`) groundwater, aquifer delineation and contaminant migration, (2) slope stability and engineering site characterization, (3) detection of abandoned landfills, underground storage tanks, UXO, (4) earthquake, sinkholes, and land subsidence hazards, and/or (5) non-invasive archeological site assessment. Students will gain hands-on experiences in both collecting geophysical data in the field and processing real field data in the lab. Field trips required. May not be used for degree credit with GEOL 4443.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 5453 Groundwater Modeling
Prerequisites: GEOL 4453 or equivalent, MATH 2144, MATH 2153 each with a grade of "C" or higher.
Description: Modeling ground water systems. Realistic problems to acquaint students with the movement of geological fluids. Developing models of fluid movement through the subsurface using geological and geophysical data. Field trips required.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5463 Physical Hydrogeology
Prerequisites: GEOL 4453 or equivalent with a grade of C or better; PHYS 2114 with a grade of C or better.
Description: Physical ground-water systems. Realistic problems to acquaint students with ground-water occurrence and movement. Geologic, geophysical, hydraulic testing and modeling techniques used to define an actual ground-water system. Ground-water regulations. Field trips required. May not be used for degree credit with GEOL 4463.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5483 Petroleum Water Management
Prerequisites: Minimum grade of "C" in GEOL 4453 and MATH 2153, or consent of instructor.
Description: Developing, maintaining, and disposing or recycling water for use in the petroleum industry. Problems associated with water production and disposal including water quality issues and seismicity. Field trips required.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5513 Marine Geology
Prerequisites: Minimum grade of "C" in: GEOL 1014 or GEOL 1114 or GEOL 1214 or GEOL 4503.
Description: Comprehensive examination of the geology of the ocean basins. Topics include: techniques of data collection and interpretation; shoreline, shelf and deep ocean processes; physical oceanography; origin and distribution of marine sediments; paleoceanography; marine mineral resources; marine tectonics and ocean history. Same course as GEOL 4513. May not be used for degree credit with GEOL 4513.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5523 Environmental Organic Geochemistry
Prerequisites: CHEM 1314 and 1515 or equivalent; GEOL 3034 or equivalent; GEOL 4403 or equivalent or permission of instructor.
Description: Introduction to some environmental aspects of organic geochemistry. Soils and sediments as pollutant receptors, sources of pollutants and selected aspects of environmental health.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5533 Organic Geochemistry
Description: Introduction and broad overview of the biogeochemistry of organic compounds in geological systems, including sediments, water, and paleoenvironments.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5543 Introduction to Exploration Seismology
Description: Introduction to theory, techniques, and application of seismic to field of hydrocarbon, groundwater, and minerals exploration. Review of fundamentals of wave propagation, historical development of the science, and current literature on application and instrumentation. No credit for students with credit in GEOL 4543.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5573 Marine Biogeochemical Cycles
Prerequisites: GEOL 1224 and GEOL 4403 and CHEM 1314.
Description: Analysis of the interactions between geological processes, biological activity, and chemical cycling for a range of elements. Limited discussion of atmospheric, terrestrial, and freshwater systems as they impact the oceans will also be discussed. Includes discussions of changes in elemental cycles through Earth's history and comparison to present-day patterns. No credit for credit in GEOL 4573.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5583 Environmental Data Analytics
Prerequisites: Minimum grade of "C" in MATH 2144.
Description: Provides theoretical and practical experience in extracting meaning from complex and heterogeneous environmental data sources to understand and manage the natural environment (geosphere, hydrosphere, biosphere, and atmosphere). May not be used for degree credit with GEOL 4583.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5603 Basin Evolution
Prerequisites: GEOL 3014, GEOL 3034, GEOL 4403.
Description: Advanced topics in sedimentary basin studies, including tectonics, sequence stratigraphy, facies analysis, regional diagenesis, thermal evolution, regional hydrogeology, and distribution of natural resources.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5633 Exploration Prospect Evaluation
Prerequisites: Graduate standing and permission of the instructor.
Description: Evaluation of exploration prospects in frontier and underdeveloped petroleum provinces using borehole-derived and geophysical data. Team taught course that uses industry provided datasets and current data management and interpretation software to reach drill or no-drill decisions based on science, risk analysis and economics.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5643 Seismic Data Processing
Prerequisites: Consent of instructor.
Description: Theoretical background and practical training in the processing of seismic reflection and refraction data for petroleum, environmental, and engineering applications. Hands-on digital data processing using standard industry software. Topics to be covered include digital filtering, statics corrections, velocity analysis, deconvolution, stacking, and migration. May not be used for degree credit with GEOL 4643.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5753 Volcanology
Prerequisites: GEOL 2464 or equivalent with a grade of "C" or higher.
Description: Examination of volcanic processes, products, and structures on Earth and other terrestrial bodies. Optional field trip. No credit for students with credit in GEOL 4753.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5773 Planetary Geology
Prerequisites: GEOL 1114, and GEOL 3073 recommended.
Description: Geology of planets and planetary bodies, including geomorphology, tectonics, geochemistry and geophysics; perspectives on exploration; and life in the universe. Course previously offered as GEOL 4773.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 5803 Fundamentals of Carbon Capture and Geologic Storage
Prerequisites: Admission to the Geoscience PSM or instructor permission.
Description: This course covers the fundamentals of carbon capture and storage and includes and introduction and summary of storage and capture technology, the CO2 sources that are suited to this technology, and economic and policy drivers. The course considers the full spectrum of geological opportunities for CO2 storage and CO2-enhanced oil and gas recovery, as well as basic operational design.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5813 Multiphase Flow and Transport of CO2 in Subsurface
Prerequisites: Admission to the Geoscience PSM or instructor permission.
Description: This course covers several aspects of CO2 transport in the subsurface and evaluates the safe storage of CO2 plumes. It explores in detail the challenges of geological storage. Topics to be covered include, but are not limited to plume migration, leakage risk, CO2 dissolution into the aqueous phase, capillary-entrapped CO2, and potential for in-situ CO2 mineralization.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5823 Fundamentals of Water-Rock-CO2 Interactions
Prerequisites: Admission to the Geoscience PSM or instructor permission.
Description: This course covers the fundamentals of water-rock-CO2 interactions and will provide a combination of theoretical background, numerical modeling, and case studies from several pilot and commercial projects. The course will highlight the challenges of data collection from the field and from available datasets.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5833 Geomechanics and Seismicity in Geological Carbon Storage
Prerequisites: Admission to the Geoscience PSM or instructor permission.
Description: This course covers the scientific fundamentals of seismology and geomechanics for a broad understanding of induced seismicity. Course covers a broad background on the fundamentals of geophysics and geology, specifically how stress in the earth interacts with faults and fractures.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5843 4D Dynamic Reservoir Characterization
Prerequisites: Admission to the Geoscience PSM or instructor permission.
Description: This course will utilize case studies to introduce participants to the art of interpreting time-lapse (4-D) multicomponent (9-C) seismic in terms of dynamic changes in rock properties. The modeling and interpretation techniques taught in this course can be applied to any porous subsurface system where fluid injection or extraction processes cause changes in the elastic subsurface rock properties. Knowledge gained can be transferred to examine systems such as carbon storage, geothermal, wastewater disposal, and heavy oil extraction.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5853 Social, Legal, and Regulatory Context for Carbon Capture and Storage
Prerequisites: Admission to the Geoscience PSM or instructor permission.
Description: This course will provide an overview of the social, legal, and regulatory context for participants to navigate aspects of carbon capture and storage (CCS) and energy transition projects. Using case histories, guest speakers, and experiential learning, this course introduces participants to the landscape in which project developers, regulators, policymakers, and industry providers will be expected to operate in to engage in Energy Transition projects.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5863 3D Seismic Exploration
Prerequisites: Admission to the Geoscience PSM or instructor permission.
Description: Students will learn how to use principles of seismic stratigraphy, seismic geomorphology, structural geology, and rock physics to interpret seismic reflection data and associated attributes to delineate faults, fractures, folds, fluvial-deltaic complexes, turbidites, mass transport complexes, karst, and other structural and stratigraphic features of interest. Course is intended for graduate students in geosciences or petroleum engineering.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5883 Risk Analysis in Conventional and Unconventional Reservoirs
Prerequisites: Admission to the Geoscience PSM or instructor permission.
Description: The course will review several conventional and recent unconventional discoveries with an emphasis on the technical geologic and engineering variables. The geologic emphasis of each play will focus on basin development, petroleum systems, super-basin concepts, and as analogs for future exploration and development in these and other innovations. Economic, financial, and oil & gas industry portfolio evaluation will be introduced.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5893 Evolution of Sandstone Reservoirs
Prerequisites: GEOL 3034 and 3014.
Description: Sandstones and sands form major oil and gas reservoirs and critical aquifers. This course examines coarser siliciclastic bodies and follows their evolution from sediment to rock. Topics investigated include depositional settings and environments, distribution and geometry of sand bodies and the role of biotic activity and diagenesis in enhancing or reducing reservoir quality.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 5981 Geoscience Internship
Prerequisites: Consent of instructor.
Description: Student participation in a research project during an internship in a Geoscience-related professional work setting for graduate credit. Graded on a pass/fail basis.
Credit hours: 1
Contact hours: Contact: 1 Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Geology

GEOL 5990 Advanced Studies in Geology
Prerequisites: Consent of instructor.
Description: Individual library, laboratory and/or field projects on facets of geology not covered by existing courses. Field trips may be required. Course previously offered as GEOL 5710. Offered for variable credit, 1-6 credit hours, maximum of 12 credit hours.
Credit hours: 1-6
Contact hours: Contact: 1-6 Other: 1-6
Levels: Graduate
Schedule types: Independent Study
Department/School: Geology

GEOL 6000 Doctoral Dissertation Research
Description: Work toward doctoral dissertation in Geology. Offered for variable credit, 1-12 credit hours, maximum of 60 credit hours.
Credit hours: 1-12
Contact hours: Contact: 1-12 Other: 1-12
Levels: Graduate
Schedule types: Independent Study
Department/School: Geology

GEOL 6103 Gravity and Magnetic Methods
Prerequisites: GEOL 4103.
Description: Principles of gravity and magnetic methods applied to petroleum, mineral, and groundwater exploration. Engineering applications will also be discussed. Data acquisition, processing and modeling using standard industry software will be emphasized.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 6133 Unconventional Petroleum Reservoirs
Prerequisites: GEOL 4023.
Description: Review of unconventional sources of oil and gas production including coalbed methane, tight gas-sandstones, gas and oil-bearing shales and transition zone, high-water saturation sandstones and carbonates.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 6213 Plate Tectonics
Description: Earth's evolution within the framework of plate tectonics. Examination of structural associations in relation to tectonic plate boundaries. Mechanisms for place tectonics and implication for resources and the environment. May not be used for degree credit with GEOL 4213.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 6283 Geology of Shales
Prerequisites: Graduate standing or permission of instructor.
Description: Team-taught course that combines different geological techniques towards gaining a better understanding of shales as source and reservoir rock. These include petrography, XRD, SEM, Organic and Inorganic chemistry, geophysical logs, paleoecology and biostratigraphy. This course will involve lecture as well as laboratory techniques.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 6303 Electrical and Electromagnetic Methods
Prerequisites: GEOL 4103.
Description: Principles of the different geoelectrical methods, including electrical resistivity, induced polarization, self potential, electromagnetic, and ground penetrating radar will be emphasized. Geophysical instrumentation, laboratory measurements of physical properties, field procedures, and basic interpretation and near surface geophysical applications will be discussed. Recent advances in geoelectrical methods and case studies will be examined by reviewing current literature. Field trip required.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 6363 Carbonate Reservoir Characterization
Prerequisites: GEOL 5363 or Admission to the Geoscience PSM or instructor permission.
Description: A review of depositional and diagenetic controls on carbonate reservoir heterogeneity from pore scale to the geometrical attributes at reservoir-scale and how these parameters can be incorporated into the development of viable petrophysically-based reservoir models. In-class readings and exercises are used to reinforce the potential integration of petrophysical, geological and other data sets to provide students with experience in carbonate reservoir characterization for oil and gas, groundwater and CCUS reservoirs. This is a seminar and project-based course.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 6373 Advanced Carbonate Petrology and Geochemistry
Prerequisites: GEOL 4403 with a grade of "C" or higher and GEOL 5363 with a grade of "B" or higher or equivalents or consent of instructor.
Description: This course will cover advanced topics in carbonate petrology and geochemistry with emphasis on both early and late diagenetic processes, dolomitization, porosity and permeability, geochemical evolution of seawater and carbonate sediments, and regional diagenetic patterns in carbonate rocks and related strata.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 6386 Sequence Stratigraphy of Shales
Prerequisites: Graduate standing. Intensive field course focusing on hydrocarbon-bearing shales of the Midcontinent.
Description: Advanced field techniques including high resolution spectral gamma ray analysis and highly detailed measured sections will be taught. Fifty localities including Devonian-Early Mississippian (Woodford and Chattanooga shales), Upper Mississippian (Barnett, Caney, and Fayetteville shales) and Pennsylvanian-Lower Permian shales will be analyzed.
Credit hours: 6
Contact hours: Lecture: 2 Lab: 12 Contact: 14
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 6503 Rock Fractures
Description: Mechanical analysis and tectonic implications of brittle structural features such as joins, veins, and faults. Examination of topics such as mechanical stratigraphy in layered rocks, factors controlling joint spacing, and the dependence of failure mode on lithology. Field trips may be required.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Geology

GEOL 6553 Contaminant Hydrogeology
Prerequisites: GEOL 4453 or an equivalent.
Description: Contaminant Hydrogeology will evaluate characterization and remediation approaches in a range of geologic settings for common subsurface impacts. Course will cover saline impacts, nonaqueous phase liquids, and emerging contaminants. Course previously offered as GEOL 5553.
Credit hours: 3
Contact hours: Lecture: 1 Lab: 4 Contact: 5
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

Undergraduate Programs

- Environmental Geoscience, BS (http://catalog.okstate.edu/arts-sciences/geology/environmental-geoscience-bs/)
- Geology, BS (http://catalog.okstate.edu/arts-sciences/geology/bs/)
- Geology: Business Essentials, BS (http://catalog.okstate.edu/arts-sciences/geology/business-essentials-bs/)
- Geology: Environmental Geology, BS (http://catalog.okstate.edu/arts-sciences/geology/environmental-bs/)
- Geology: Petroleum Geology, BS (http://catalog.okstate.edu/arts-sciences/geology/petroleum-bs/)
- Geology: Pre-Law, BS (http://catalog.okstate.edu/arts-sciences/geology/pre-law-bs/)
- Geology: Secondary Teacher Certification, BS (http://catalog.okstate.edu/arts-sciences/geology/secondary-teacher-certification-bs/)
- Geophysics, BS (http://catalog.okstate.edu/arts-sciences/geology/geophysics-bs/)

Graduate Programs Prerequisites

The student should have at least 30 credit hours in geosciences. Credit hours must include courses in physical geology, historical geology, rocks and minerals/mineralogy, sedimentology/stratigraphy, structural geology, field camp, or other courses relevant to the student's graduate research. Additional undergraduate requirements to enter the graduate programs include: two courses in chemistry/geochemistry, two courses in physics, and/or math courses through calculus II. Deficiencies in coursework must be made up by the student after entering the program. The Graduate Record Examination is recommended, but not required, for admission to the program.

The Master of Science Degree

The MS is awarded through the completion of a thesis. Each candidate must complete at least 30 semester credit hours of work beyond the prerequisites. As many as 12 of these may be taken in other departments of the University upon approval by the candidate's advisory committee. A final defense of the thesis and the research that it documents is required of all students.

The Doctor of Philosophy Degree

The PhD is awarded upon completion of a doctoral dissertation. A minimum of 60 credit hours (coursework and research hours) beyond the MS or MA degree are required for the PhD. Under normal circumstances, students must hold a master's degree in geology or a related field to be accepted into the PhD program. However, under exceptional

circumstances, students may be accepted directly into the PhD program without a master's degree. Such students will be required to complete a total of 90 semester credit hours (coursework and research hours) to earn their degree. Such decisions are made by the entire faculty of the School of Geology, upon recommendation of the Graduate Advisor. To be admitted to candidacy, students must pass a written and oral qualifying exam, and successfully defend their dissertation research proposal and pass an associated comprehensive exam. The PhD is conferred after the successful defense of the dissertation.

Accelerated Master of Science Degree

Our School is proud to offer an Accelerated MS option. Students who wish to pursue an Accelerated Master's should have completed 90 or more hours toward their BS by the end of their term of application, including GEOL 3014 and GEOL 3034, and should have a strong background with undergraduate research. Students who are admitted into the Accelerated Master's program will be eligible to share 9 credit hours between their BS and MS degrees.

Minors

- Geology (GEOL), Minor (http://catalog.okstate.edu/arts-sciences/geology/geology-minor/)
- Geophysics (GPHY), Minor (http://catalog.okstate.edu/arts-sciences/geology/geophysics-minor/)
- Oceanography (OCEN), Minor (http://catalog.okstate.edu/arts-sciences/geology/oceanography-minor/)

Faculty

Interim Department Head—Todd Halihan, Ph.D. (Hydrogeology and Hydrogeophysics)
Professors: G. Michael Grammer, Ph.D. (Carbonate Sed/Strat and Reservoir Characterization); Todd Halihan, Ph.D. (Hydrogeology and Hydrogeophysics); Priyank Jaiswal, Ph.D. (Geophysics, Inverse Theory and Data Analytics); Camelia Knapp, Ph.D. (Exploration Geophysics); James H. Knapp, Ph.D. (Tectonics and Geophysics); Jack Pashin, Ph.D. (Structural Geology, Basin Analysis and Sedimentary Geology); Jim Puckette, Ph.D. (Petroleum Geology and Geoscience Education); Tracy Quan, Ph.D. (Isotope/Organic Geochemistry)
Associate Professors: Daniel Laó Dávila, Ph.D. (Structural Geology and Tectonics); Natascha Riedinger, Ph.D. (Sedimentary Geochemistry); Javier Vilcaez, Ph.D. (Geological Engineering and Fluid Dynamics)
Assistant Professors: Ashley Burkett, Ph.D. (Micropaleontology, Biostratigraphy, and Climate); Ahmed Ismail, Ph.D. (Near Surface Geophysics and Exploration Seismology); Tingying Xu, Ph.D. (Hydrogeochemistry and Metal (Bio)Geochemistry); Yipeng Zhang, Ph.D. (Hydrogeology)
Teaching Assistant Professor: Brandon Spencer, Ph.D. (Structural Geology, Igneous Petrology, and Geo Education)
Visiting Associate Professor: Mary Hileman, Ph.D. (Sedimentology and Petroleum Geology)
Adjunct Assistant Professor: Caitlin Barnes, Ph.D. (Hydrogeology, Science Education, and Online Education)