

GEOLOGY (GEOL)

See the Financial Information (<https://catalog.wheaton.edu/financial-information/>) section of this catalog for course fees.

GEOL 201. Exploring the Dynamic Earth - Field. (4 Credits)

Introduction to geoscience in the field, focus on geological history of the SD Black Hills through on-site study of rocks, minerals, fossils, and earth processes as seen in rock strata, folds, faults, mountains, mines and other human impacts on the environment. Emphasis on field excursions and data collection procedures (topographic and geologic maps, sample collection, and feature interpretations). "Indoor" lab work supports the fieldwork. Offered only at the Wheaton College Science Station.

GEOL 206. Geology of National Parks - Field. (4 Credits)

This course utilizes national parks, monuments, and forests to introduce students to geologic processes, cycles, and systems in a field context. Students will visit and directly observe the geology of national parks, monuments, and forests during extensive fieldwork. Potential field excursions include visits to Yellowstone, Grand Tetons, Wind Cave, and Badlands National Parks as well as national monuments and forests, such as Mount Rushmore, Devils Tower, and Jewel Cave. Additionally, students will design and perform field experiments in analog systems within the Black Hills region and utilize Google Earth to collect geologic data directly for national parks. Students also have the opportunity to consider the historical, social, governmental policy, environmental management, and theological implications of wilderness and natural areas and to engage with claims about the age of the Earth. Offered at the Wheaton College Science Station.

Tags: SP

GEOL 212. The Dynamic Earth and Environment. (4 Credits)

Introduction to the processes, cycles and systems of earth and environment. Special emphasis on human dependence upon earth's physical properties and processes and the environmental impacts of human activity. Plate tectonics and environmental systems provide frameworks for understanding earth materials and structures, global change, natural hazards (volcanoes, earthquakes, floods), water resources (surface and ground water, glaciers), biological/agricultural resources, energy and mineral resources, and associated environmental hazards. Explorations of biblical creation accounts and environmental stewardship relevant to course topics. Three and a half hours lecture and two hours laboratory per week. Field trip fee.

Tags: SP

GEOL 232. Environmental Geochemistry. (4 Credits)

Solutions; kinetics; chemical equilibrium; acid/base chemistry; carbonate chemistry; oxidation/reduction chemistry; carbon, nitrogen, phosphorous and sulfur cycles; surface chemistry; atmospheric chemistry; chemical weathering and soils; environmental mineralogy; diagenesis; organic geochemistry; radiogenic isotopes; stable isotopes. Three and a half hours lecture and three hours laboratory per week. Field trip fee and lab fee. Alternate years. Prerequisite: GEOL 201 or GEOL 212 or ENVR 212; and CHEM 231.

GEOL 308. Energy & Climate Change. (4 Credits)

Climate science basics including Earth systems interactions between sun, land, sea, air and life that control climate conditions. Review of climate change in Earth history and the influence of human activity on climate. Introduction to methods for documenting climate conditions past and present for monitoring change and application of data to models for predicting global change. Overview of international efforts to monitor and mitigate global change and shift energy production from fossil fuels to renewable sources. Review of history, science, economics and policy of energy resources from the industrial revolution to future technologies.

Tags: SIP

GEOL 321. Earth History and Stratigraphy. (4 Credits)

Basic principles of interpreting Earth history: geologic time, stratigraphic analysis, reconstructing past environments. Actualism, catastrophism and engagement with Christian theology in the historical development of geology. Overview of Earth history including origin of Earth-Moon, history of life, stratigraphic record and tectonic activity. Three hours lecture, two hours laboratory. Prerequisite: GEOL 212 or ENVR 212. Additional course fee required: \$25 lab, \$120 field trip.

Tags: SIP

GEOL 332. Studies In Regional Geology. (1 or 2 Credits)

Geologic study in the field of a selected region during an excursion over spring vacation or in May following commencement. Learning emphasis is on structural and stratigraphic framework, interpretation of geologic history, and natural resources of the region. Assignments include background readings, participation in discussions in the field, and preparation of field notes. Field trip fee varies by destination. (1 or 2 credit hrs, repeatable for a max. of 4) Prerequisite: GEOL 201 or GEOL 212 or ENVR 212.

GEOL 336. Process Geomorphology. (4 Credits)

The study of earth surface processes and the landforms they produce in the context of engineering and environmental applications. Topics include processes and landforms associated with: weathering, mass wasting, rivers, karst, neotectonics, glaciers, shorelines, and wind. Individual project and laboratory assignments required, including qualitative descriptions and quantitative measurements from topographic and geologic maps, and aerial photographs. Three and a half hours lecture and three hours laboratory per week. Field trip fee and lab fee. Alternate years. Prerequisite: GEOL 201 or GEOL 212 or ENVR 212.

GEOL 341. Environmental Statistics and Modeling. (4 Credits)

Mathematical approaches to quantitatively describe, analyze, and understand environmental processes. Descriptive and inferential statistical techniques and numeric modeling are used to address environmental problems. Emphasis is on applications of the methods to practical problems and the use of computer resources. Three and a half hours lecture, two hours laboratory per week.

Tags: AAQR

GEOL 343. Fundamentals of Mineral Science. (2 Credits)

A brief survey of theory and applications in mineralogy. Emphasis is on chemical classification, modes of occurrence, modern techniques of mineral identification, and utility. Three and a half hours lecture and two hours laboratory per week. Lab fee. Alternate years. Prerequisite: GEOL 201 or GEOL 212 or ENVR 212.

GEOL 344. Igneous and Metamorphic Petrology. (4 Credits)

The study of igneous and metamorphic rocks along with related topics in high-temperature geochemistry. Lecture sessions present petrogenesis and classification within the context of different plate tectonic settings. The emphasis is on topics such as magmatic melting and crystallization processes; the role of temperature, pressure, and fluids; thermodynamics; and isotope and trace element geochemistry. Laboratory projects include the identification and observation of rock types and their variation, quantitative use of thermodynamics and geochronology, and the significance of rock fabrics as observed in hand specimen and thin section. Three and a half hours lecture and three hours laboratory per week. Field trip fee and lab fee. Alternate years. Prerequisite: GEOL 343; GEOL 232 recommended.

GEOL 345. Sedimentary Geology. (2 Credits)

Description and interpretation of sedimentary rocks with emphasis on field content. Topics include classifications, sediment provenance, application of depositional facies models, diagenesis, basin analysis, and natural resources. Methods include field techniques and petrographic analysis of thin sections. Generally taught at the Wheaton College Science Station. Alternate years, SU. Prerequisite: GEOL 201 or GEOL 212 or ENVR 212; GEOL 321 recommended.

GEOL 355. Introduction to Soil Science. (2 Credits)

Basic survey including the origin and properties of soils, their classification and applications to agriculture, third world development, engineering, environmental issues. Laboratory and field experiences will provide opportunities to observe soil profiles and measure physical properties. Three and a half hours lecture and two hours laboratory per week. Field trip fee and lab fee. Offered irregularly.

GEOL 365. Physics of the Earth. (2 Credits)

Principles and applications of geophysics related to the study of the Earth's deep interior and geophysical prospecting. Topics include earthquake seismology, Earth's gravity, shape, magnetism, paleomagnetism, heat flow, temperature, and geodynamics. Also applied methods of seismic reflection and refraction, gravimetry, magnetism, electromagnetism, and resistivity. Three and a half hours lecture and two hours laboratory per week. Lab fee. Offered irregularly. Prerequisite: one four-hour physics laboratory course.

GEOL 371. Introduction to Geographic Information Systems. (2 Credits)

The hardware and software technology of GIS programs. Basic concepts of spatial data collection, storage, processing, and interpretation, combined with remote sensing. Uses the popular GIS software ArcGIS. Three and a half hours lecture and two hours laboratory per week. Lab fee.

GEOL 372. GIS Practicum. (2 Credits)

Application of GIS methods to student-designed projects. Hardware and software expertise derived from GEOL 371. Two hours directed research, one hour discussion per week. Pre or Corequisite: GEOL 371.

GEOL 385. Topics in Earth Science. (2 or 4 Credits)

Selected topics from the following: economic geology, appropriate technologies, tectonics, and regional studies. Lectures or lecture/laboratory. Prerequisite: GEOL 201 or GEOL 212 or ENVR 212.

GEOL 395. Geoscience Research. (1 or 2 Credits)

Field, laboratory, or literature research in the geosciences under faculty direction. Application of data gathering and analysis methods. Communication of results in multiple formats. Prerequisite: Instructor approval.

GEOL 412. Field Geology. (6 Credits)

The comprehensive exercise of geological field techniques and interpretation in the context of western South Dakota and the Rockies. Projects involve the preparation of maps and reports from diverse areas and of varying complexity. Offered only at the Wheaton College Science Station. Alternate years, SU. Prerequisite: GEOL 443.

GEOL 413. Rocky Mountain Geology. (2 Credits)

Field geological study in the northern Rocky Mountains of South Dakota, Montana, and Wyoming. Observation of rock, strata, and structures in classic localities, including Black Hills, Devil's Tower, Big Horn and Bear Tooth Mountains, and Yellowstone and Grand Teton National Parks. Alternate years, SU.

GEOL 437. Hydrogeology. (4 Credits)

Basic processes and measurement of the hydrologic cycle, including: precipitation, evaporation, surface runoff, stream flow, soil moisture, and groundwater. Emphasis placed on groundwater, including: geology of occurrence, principles of flow, conceptual models of regional flow, chemistry and quality, well hydraulics, aquifer characteristics, resource development, detection of pollutants, and contaminant transport. Three and a half hours lecture and three hours laboratory per week. Field trip fee and lab fee. Alternate years. Prerequisite: GEOL 201 or GEOL 212 or ENVR 212.

GEOL 443. Structural Geology. (4 Credits)

Architecture of the dynamic earth. Earth movement and deformation in the context of plate tectonics. Laboratory simulation of stress and strain, study of deformed rocks, and interpretation of geologic maps; measurements and computations. Three and a half hours lecture and three hours laboratory per week. Field trip fee and lab fee. Alternate years. Prerequisite: GEOL 344.

GEOL 494. Senior Seminar for Geology Majors. (2 Credits)

Integration seminar for seniors or for juniors who have completed most geology requirements. Reading and discussion of history and philosophy of geological science and critical reflection of student's experience in Christian liberal arts education, understanding of vocation and ethical considerations of practice. Prerequisite: Completion of 16 credit hrs of GEOL courses.

General Education: SHAR

GEOL 495. Geoscience Independent Study. (2 to 4 Credits)

Field, laboratory or library research involving selection of a research problem, review of appropriate professional literature, completion of data collection and analysis, and preparation of a written report. Student will be encouraged to present results in an appropriate professional venue. Requires direct supervision and mentoring by geoscience faculty. Prerequisites: consent of instructor and department chair.

GEOL 496. Internship. (1 to 4 Credits)

Supervised off-campus experience with departmental approval. Graded pass/fail. Prerequisite: junior or senior standing with Geology or Environmental Studies major. (credit variable)

GEOL 499. Geoscience Honors Research. (1 to 4 Credits)

An independent project providing original geoscience research developed in a written honors thesis and culminating in an oral examination. Partially fulfills requirements for an honors degree in geoscience. Additional requirements are available in the Geology and Environmental Science office or on the department web page. Prerequisite: Acceptance to the Geoscience Honors program.

Note: GEOL 308 credit not applicable for Geology majors.