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. Field trip fee. Offered only at the Science Station. Three hours lecture, three hours laboratory.
Tags: SP

GEOL 211. Exploring the Dynamic Earth. (4 Credits)
Introduction to the physical properties and processes of the Earth with special emphases on the current practice of geology and its significant contributions to humans and the environment. Topics are presented in the plate tectonic framework to include minerals and rocks, igneous activity, earthquakes, rivers, ground water, glaciers, and energy and mineral resources. Field trip fee. Three hours lecture, two hours laboratory.
Tags: SP

GEOL 212. 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 hours lecture and two hours laboratory. 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, phosphorus and sulfur cycles; surface chemistry; atmospheric chemistry; chemical weathering and soils; environmental mineralogy; diagenesis; organic geochemistry; radiogenic isotopes; stable isotopes. Three lectures, three hours laboratory. Prerequisites: GEOL 201 or GEOL 212 or ENVR 212; and CHEM 231.

GEOL 307. Water. the Essential Natural Resource. (4 Credits)
An overview of our most important natural resource - water. Topics include occurrence, chemistry, physiological requirement for water, effects upon past and present civilizations, surface and groundwater flow, global water supply, water pollution, water exploration and extraction.
Tags: SIP

GEOL 308. Energy & Climate Change. (4 Credits)
Human use of energy and its predicted impact upon climate change. Review of the past and present use of global fossil fuel consumption as a possible cause of climate change. Study of past climate change since the ice age, present climate, basic meteorology, and future predictions of climate change forced by energy use and the resulting impact upon civilization. Arguments for and against global warming are evaluated with analysis through the science of climate change. Concludes with consideration of alternate energy sources to mitigate any effects of climate change.
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. Field trip fee and lab fee. Three hours lecture, two hours laboratory.
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.) Prerequisite: GEOL 201, 211, or consent of instructor. (1 or 2, repeatable for a max. of 4)

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 hours lecture, three hours laboratory. Field trip fee and lab fee. Prerequisite: GEOL 201, 211, or consent of instructor. Alternate years.

GEOL 341. Quantitative Methods for Environmental Analysis and Problem Solving. (4 Credits)
Three hours lecture, two hours laboratory. See ENVR 341.
Tags: AAQR

GEOL 342. Fundamentals of Geochemistry. (2 Credits)
Principles and applications of Earth's chemical systems. Topics include low (aqueous) and higher temperature phenomena, crystal chemistry, trace-element distribution, isotopic and applied geochemical methods. Three hours lecture and two hours laboratory per week. Prerequisites: one introductory geology class (such as GEOL 201 or 211) and one semester of a chemistry lab class is recommended.

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 hours lecture and two hours laboratory per week. Prerequisites: GEOL 201, or 211. Alternate years.
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 hours lecture, two hours laboratory. Field trip fee and lab fee. Prerequisites: GEOL 201 or 212, and 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. Offered only at Wheaton College Science Station in the Black Hills. Prerequisites: GEOL 201, 211, or 212 or ENVR 212; and GEOL 321. Alternate years, SU. Three hours lecture, two hours laboratory.

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 hours lecture and two hours laboratory. Field trip fee and lab fee. Alternate years.

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 hours lecture, two hours laboratory. Prerequisite: one-four-hour physics laboratory course or permission of instructor. Alternate years. Lab fee.

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 hours lecture, two hours laboratory. Lab fee.

GEOL 372. GIS Practicum. (2 Credits)
Application of GIS methods to student-designed projects. Hardware and software expertise derived from GEOL 371 (prerequisite). Two hours directed research, one hour discussion per week.

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 211.

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 Science Station. Field trip fee and lab fee. Three hours lecture, four hours laboratory (field activity). Prerequisite: GEOL 443 or consent of instructor. Corequisite: must be taken with GEOL 413. Alternate years.

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. Field trip fee. Corequisite: must be taken with GEOL 412. Alternate years.

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 hours lecture, three hours laboratory. Field trip fee and lab fee. Prerequisite: GEOL 201, 211, or consent of instructor. Alternate years.

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 hours lecture, three hours laboratory. Field trip fee and lab fee. Pre/Corequisite: GEOL 201 or 211. Alternate years.

GEOL 494. Senior Capstone 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.

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)

Note: GEOL 307, GEOL 308 credit not applicable for Geology majors.