**Geology (GEO)**

**NOTE:** All prerequisites required for Geology (GEO) courses or courses counted toward major or minor requirements in geology must be completed with a grade of "C-" or better.

### Geology (GEO) Courses

**GEO 1013. The Third Planet.** (3-0) 3 Credit Hours. (TCCN = GEOL 1301)

Evolution of ideas concerning the earth’s origin, structure, and age; social impact of recognizing the antiquity of the planet and humankind’s brief presence; examination of how the distribution of planetary resources influenced the rise and clash of civilizations. May not be applied to a major in geology. May apply toward the Core Curriculum requirement in Life and Physical Sciences. Generally offered: Fall, Spring, Summer.

**GEO 1103. Physical Geology.** (3-0) 3 Credit Hours. (TCCN = GEOL 1303)

Prerequisites: Completion of or concurrent enrollment in CHE 1103, CHE 1121, and MAT 1093 or higher, or satisfactory performance on placement exam. Completion of or concurrent enrollment in GEO 1111 required. This course is intended for geology majors and minors as well as others interested in the geologic sciences. It constitutes an introduction to the geology major and skillsets needed by the practicing geologist including: mineral and rock identification, microscopy, deep time, outcrop descriptions, and mapping. The course includes an introduction to the theory of plate tectonics and its relation to the Earth’s internal structure, surface features, hydrosphere, earthquakes, and volcanism. One or more field trips may be required. Generally offered: Fall, Spring.

**GEO 1111. Physical Geology Laboratory.** (1-3) 1 Credit Hour. (TCCN = GEOL 1103)

Prerequisite: Completion of or concurrent enrollment in GEO 1103. Relation of the earth’s present processes to its resources, structure, and internal composition. Field and laboratory study of minerals, rocks, maps, and aerial and satellite photos. Field trips may be required. (Formerly titled “Introduction to Earth Systems Laboratory.”) Generally offered: Fall, Spring.

**GEO 1123. Life Through Time.** (3-0) 3 Credit Hours. (TCCN = GEOL 1304)

Concurrent enrollment in GEO 1131 recommended. A study of the origin and evolution of life on Earth including major events from the beginning of the Earth and solar system to the present, as well as the interaction of life with the lithosphere, atmosphere, and hydrosphere. This course will explore the fossil record, sedimentary rocks, plate tectonics, evolution, and climate change. May apply toward the Core Curriculum requirement in Life and Physical Sciences. Generally offered: Fall, Spring.

**GEO 1131. Life Through Time Laboratory.** (1-3) 1 Credit Hour. (TCCN = GEOL 1104)

Prerequisite: Completion of or concurrent enrollment in GEO 1123. Laboratory and field study of minerals, rocks, fossils, sequences of rocks, and mapping for the interpretation of life through time and the interpretation of Earth history. This course is intended and required for Geological Science majors and minors and will introduce students to many concepts covered in upper level courses. Field trips may be required. Generally offered: Fall, Spring.

**GEO 2003. Mineralogy.** (3-0) 3 Credit Hours.

Prerequisites: CHE 1103, CHE 1121, GEO 1103, GEO 1111, MAT 1093 or higher, or satisfactory performance on placement exam. Completion of or concurrent enrollment in GEO 2011. Crystallography, crystal chemistry, and the physical and optical properties of minerals. Principles of optical mineralogy and the microscopic determination of nonopaque minerals. Field trips may be required. Generally offered: Fall, Spring.

**GEO 2011. Mineralogy Laboratory.** (1-4) 1 Credit Hour.

Corequisite: GEO 2003. Laboratory study of crystal models, crystals, and minerals. Use of physical properties and the petrographic microscope for mineral identification. Field trips may be required. (Formerly GEO 2012. Credit cannot be earned for both GEO 2011 and GEO 2012.) Generally offered: Fall, Spring.

**GEO 2113. Fundamentals of Geographic Information Systems (GIS).** (2-4) 4 Credit Hours.

Prerequisite: CS 1173 or equivalent. This course will serve as a basic introduction to the concepts and techniques of utilizing a Geographic Information System (GIS) to study and model environmental issues. In lecture and laboratory, students will study methods of querying, analyzing, creating and displaying GIS data utilizing industry standard software. Students will also be introduced to using the Global Positioning System (GPS) as a means for creating GIS data. (Same as ES 2113. Credit cannot be earned for both GEO 2113 and ES 2113.) Generally offered: Fall, Spring.

**GEO 3004. Rocks, Fossils, and Global Tectonics.** (2-4) 4 Credit Hours.

Prerequisites: GEO 1103 and GEO 1111. An investigation of the major rock forming minerals, petrogenesis of the major rock types, and their plate tectonic context. Study of major trends in fauna and flora through time and their application to interpreting plate tectonics, paleoenvironments, and paleoclimate. Credit may not be applied to a B.S. or B.A. major in Geology.

**GEO 3043. Petrology.** (3-0) 3 Credit Hours.

Prerequisites: GEO 2003, GEO 2011, MAT 1214, and completion of or concurrent enrollment in GEO 3051. Description, classification, occurrence, and origin of igneous and metamorphic rocks. Field trips may be required. Generally offered: Spring.

**GEO 3051. Petrology Laboratory.** (1-4) 1 Credit Hour.

Prerequisites: GEO 2003, GEO 2011, and completion of or concurrent enrollment in GEO 3051. Description, classification, occurrence, and origin of igneous rocks. Field trips may be required. (Formerly GEO 3052. Credit cannot be earned for both GEO 3051 and GEO 3052.) Generally offered: Spring.

**GEO 3063. Paleontology.** (3-0) 3 Credit Hours.

Prerequisites: GEO 1103, GEO 1111, GEO 1123, GEO 1131, GEO 3123, GEO 3131, or consent of instructor, and concurrent enrollment in GEO 3071. Study of fossil animals and plants. Emphasis on invertebrate animals. Systematics, biostratigraphy, paleoecology, and evolution of fossil organisms. Field trips may be required. Generally offered: Spring.

**GEO 3071. Paleontology Laboratory.** (1-3) 1 Credit Hour.

Prerequisites: GEO 1103, GEO 1111, GEO 1123, GEO 1131, GEO 3123, GEO 3131, and concurrent enrollment in GEO 3063. Study of fossil specimens, collections, and preparation techniques. Field trips may be required. Generally offered: Spring.
GEO 3103. Structural Geology. (3-0) 3 Credit Hours.
Prerequisites: GEO 3043, GEO 3051, GEO 3113, and completion of or concurrent enrollment in GEO 3111. Description and origin of geologic structures at the microscopic, hand specimen and mountain scales with emphasis on the response of Earth materials to stress and the role of rheology. Relationships between structure and tectonics will be explored. Field trips may be required. Generally offered: Spring.

GEO 3111. Structural Geology Laboratory. (1-3) 1 Credit Hour.
Prerequisite: Completion of or concurrent enrollment in GEO 3103. Laboratory study of structural features and concepts using maps, cross-sections, photographs, and descriptive geometric and stereographic methods. Field trips may be required. Generally offered: Spring.

GEO 3113. Economic Geology. (3-0) 3 Credit Hours.
Prerequisites: GEO 2003 and GEO 2011. Introduction to techniques for studying geologic features and processes in the field, including rock identification, construction of geological maps, orientation analysis, and report writing. Some half-day and Saturday field trips may be required. (Formerly GEO 3112. Credit cannot be earned for both GEO 3112 and GEO 3113.)

GEO 3123. Sedimentation and Stratigraphy. (3-0) 3 Credit Hours.
Prerequisites: GEO 1123, GEO 1131, GEO 2003, GEO 2011, and completion of or concurrent enrollment in GEO 3131. Processes of erosion, transportation, and deposition that form bodies of sedimentary rock. Depositional systems and modeling are a significant area of study. Stratigraphic principles and temporal and spatial facies relationships at various scales. Field trips may be required. (Formerly titled “Sedimentary Geology.”) Generally offered: Fall.

GEO 3131. Sedimentation and Stratigraphy Laboratory. (1-3) 1 Credit Hour.
Prerequisites: GEO 2003, GEO 2011, and completion of or concurrent enrollment in GEO 3123. Laboratory studies of sedimentary processes and their products. Hand specimens, thin sections, sedimentary structures, and interpretation of depositional environments. Stratigraphic case studies, including surface, subsurface, and sequence stratigraphic analysis. Field trips may be required. (Formerly titled “Sedimentary Geology Laboratory.”) Generally offered: Fall.

GEO 3143. Economic Geology. (3-0) 3 Credit Hours.
Prerequisites: GEO 2003, GEO 2011, and completion of or concurrent enrollment in GEO 3151. Origin and occurrence of economic natural resources including metallic ore deposits, industrial minerals, and fossil fuels. Field trips may be required.

GEO 3151. Economic Geology Laboratory. (1-3) 1 Credit Hour.
Prerequisites: GEO 2003, GEO 2011, and completion of or concurrent enrollment in GEO 3143. Laboratory study of ore specimens and industrial minerals from important ore localities. Field trips may be required.

GEO 3163. Oceanography. (3-0) 3 Credit Hours.
General oceanography, with emphasis on marine geology and especially the continental margins. An optional field trip may be offered. Generally offered: Spring.

GEO 3173. Polar Regions and Climate Change. (3-0) 3 Credit Hours.
This course covers properties, areal distribution, seasonal change and climatic change of the major constituents of the Polar Regions: the large ice sheets of Greenland and Antarctica; seasonal snow cover in the high and mid latitudes; sea ice covers in the Arctic, Southern Ocean and other seas; mountain glaciers from the tropics to the polar regions; and permafrost in the high latitude land areas of the Northern Hemisphere. How to examine these constituents will be presented with illustrative examples of monitoring of climate-induced changes in the Polar Regions using remote sensing and field investigations of processes and properties. Applications discussed will include: snow and ice covers as agents of geological change; snow and ice impacts as water resources in Asia and western North America, and global environmental impact through for example, effects on the earth’s radiation budget, and contributions to sea level change. Human impacts covered will include effects of ice covers of rivers and sea ice such as on petroleum extraction, transportation and navigation, frost and freezing damage to crops, and hazards of blizzards and avalanches.

GEO 3343. Introduction to Geospatial Technologies. (3-0) 3 Credit Hours.
This course introduces several aspects of geospatial technologies, not only what they are but how they are used in hands-on applications, all based on free internet resources not commercial software packages. This course provides a solid foundation on which further knowledge in more specialized classes, such as Geographic Information Systems, Global Positioning Systems, and Remote Sensing, can be built on.

GEO 3374. Geochemistry. (2-4) 4 Credit Hours.

GEO 3383. General Geophysics. (3-0) 3 Credit Hours.
Prerequisites: Completion of or concurrent enrollment in MAT 1224 and PHY 1963. This course examines the interrelated geology and physics of the Earth’s interior as deduced from earthquake seismology, gravity and magnetic fields, and the application of geophysical methods to the exploration of near-surface cultural and natural resources. Topics in archeological, environmental, and engineering geophysics will be explored through the methods of refraction seismology, electrical resistivity, electromagnetic induction, microgravity, and ground penetrating radar. Field trips may be required.

GEO 3393. Introduction to Isotope Geochemistry. (3-0) 3 Credit Hours.
Prerequisites: GEO 1103, GEO 1111, CHE 1103, CHE 1121, and MAT 1214. The course includes a review of theories of nuclear structure, stability of nucleus, nucleosynthesis and origin of elements, and introduces both radiogenic and stable isotope geochemistry. Topics include radioactive decay schemes for tritium-helium, U-Pb, Rb-Sr, Sm-Nd, K-Ar, and U-Th-Pb-He systems; isotopic fractionations of stable isotopes of C, H, O, N, and S; and application of radiogenic and stable isotopes to petrology, evolution of the crust and mantle, geochronology, geothermometry, archaeology, ecology, hydrology, and paleoclimatic interpretation.
GEO 4013. Volcanology. (3-0) 3 Credit Hours.
Prerequisite: GEO 3043 or consent of instructor. A survey of volcanoes and volcanic processes, including historically important volcanic eruptions and the prediction and mitigation of volcanic hazards. Field trips may be required.

GEO 4023. Engineering Geology. (3-0) 3 Credit Hours.
Prerequisites: PHY 1963 (engineering majors only) or PHY 1603 or PHY 1943, and MAT 1214; or consent of instructor. Geologic factors in construction. Geotechnical properties of minerals, rocks, and soils. Case studies. May not be applied to a major in geology. Generally offered: Fall, Spring, Summer.

GEO 4033. Profession of Geology. (3-0) 3 Credit Hours.
Prerequisites: GEO 2113, GEO 3123, GEO 3131, GEO 3113. This course is designed to provide the basic knowledge required by the ASBOG National Geologist Examination (Fundamentals) for licensure as a Professional Geologist, and introduces the geoscience student to the fundamentals of professional practice that impact, health, safety, and well-being of the public. The emphasis will be on principles and practices of geoscience that affect the economy, feasibility and design of engineering works, sitting criteria, site selection and investigation, human-land interactions, site assessment, liability, responsibility, professional report writing, and licensure.

GEO 4063. Advanced Environmental Geology. (3-0) 3 Credit Hours.
Prerequisites: GEO 1103 and GEO 1111. An analysis of human interaction with geologic systems; the risks and effects of natural geologic hazards such as volcanic eruptions, earthquakes, and floods. Topics will include the effects of human activity on natural systems such as groundwater quality and recharge, river systems, coastal hazards, energy resources, and climate change. The meaning of “sustainability” as a long-term concept and tools to assess and work with Earth systems to avoid endangering human life and property are also topics that are applied and addressed. GEO 4063 is a writing intensive course and project management skills are utilized in working on geologic investigations and solutions for resource management and in analyzing and mitigating natural hazard events.

GEO 4093. Principles of Remote Sensing. (2-2) 3 Credit Hours.
Prerequisites: MAT 1214 or higher and PHY 1943. This course will provide a thorough introduction to remote sensing theory, technology, and application. The emphasis in this course is on understanding the underlying principles of acquiring, interpreting, and applying data from imaging systems covering the electromagnetic spectrum from the ultraviolet through the microwave. Generally offered: Fall.

GEO 4113. Geomorphology. (3-0) 3 Credit Hours.
Prerequisites: GEO 1103 or GRG 2613, or consent of instructor, and junior or senior standing, and concurrent enrollment in GEO 4121. Examination of landforms on the Earth’s surface and landscape-forming processes. Field trips may be required.

GEO 4121. Geomorphology Laboratory. (1-3) 1 Credit Hour.
Prerequisites: GEO 1103 or GRG 2613, or consent of instructor, and junior or senior standing, and concurrent enrollment in GEO 4113. Interpretation of landforms and their formative processes from maps, aerial photographs, and calculations. Field trips may be required.

GEO 4623. Groundwater Hydrogeology. (3-0) 3 Credit Hours.
Prerequisites: GEO 1103, GEO 1111, PHY 1943, and MAT 1214. Hydrologic cycle and the occurrence and movement of groundwater. Recharge and discharge of aquifers; water quality; exploration and development of ground-water supplies. Field trips may be required. Generally offered: Spring.

GEO 4911. Independent Study. (0-0) 1 Credit Hour.
Prerequisites: Permission in writing (form available) of the instructor, the student’s advisor, the Department Chair, and the Dean of the College in which the course is offered. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor’s degree in geology.

GEO 4912. Independent Study. (0-0) 2 Credit Hours.
Prerequisites: Permission in writing (form available) of the instructor, the student’s advisor, the Department Chair, and the Dean of the College in which the course is offered. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor’s degree in geology.

GEO 4913. Independent Study. (0-0) 3 Credit Hours.
Prerequisites: Permission in writing (form available) of the instructor, the student’s advisor, the Department Chair, and the Dean of the College in which the course is offered. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor’s degree in geology.

GEO 4933. Field Geology Part I. (1-6) 3 Credit Hours.
Prerequisites: GEO 3103, GEO 3111, GEO 3123, and GEO 3131 or consent of instructor. Part I: Field mapping and measurements. Field trips are required.

GEO 4943. Field Geology Part II. (1-6) 3 Credit Hours.
Prerequisite: GEO 4933 or consent of instructor. Part II: Field mapping and measurements. Field trips are required.

GEO 4951. Special Studies in Geology. (1-0) 1 Credit Hour.
Prerequisite: Consent of instructor. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies may be repeated for credit when the topics vary, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor’s degree.

GEO 4952. Special Studies in Geology. (2-0) 2 Credit Hours.
Prerequisite: Consent of instructor. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies may be repeated for credit when the topics vary, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor’s degree.

GEO 4953. Special Studies in Geology. (3-0) 3 Credit Hours.
Prerequisite: Consent of instructor. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies may be repeated for credit when the topics vary, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor’s degree. Generally offered: Fall.

GEO 4961. Special Studies in Geology Laboratory. (1-3) 1 Credit Hour.
Prerequisite: Consent of instructor. An organized laboratory course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies may be repeated for credit when the topics vary, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor’s degree.
GEO 4993. Honors Research. (0-0) 3 Credit Hours.
Prerequisites: Enrollment limited to candidates for College Honors during their last two semesters; approval by the College Honors Committee. Supervised research and preparation of an honors thesis. May be repeated only once with approval.