

# GEOSCIENCES (GEO)

## Courses and Descriptions

### **GEO 100 Earth Systems Science 3 Credits**

Investigates the major global processes that occur on Earth. These processes can be grouped into four major systems: atmosphere, hydrosphere, lithosphere, and cosmosphere. Each system interacts with and affects the other systems creating, in a sense, a single Earth process. With this approach, the student will view the Earth as a whole, and understand that the many seemingly separate components that make up this planet are, in fact, a set of interacting processes, that operate in cycles through time, within a single global system. Three hours of lecture per week. This course counts towards the fulfillment of the Disciplinary Perspectives element of the CLAS general education curriculum.

### **GEO 102 Earth Materials and Processes Lab 1 Credits**

This lab course introduces students to the origin, identification, and significance of geologic materials, processes, and landforms. Hands-on experiences with mineral and rock specimens, topographic and geologic maps, and GPS and other data collection techniques are emphasized, along with field trip and in-lab observations, measurements, and interpretations. One three-hour lab per week.

**Prerequisite(s):** concurrent enrollment in, or prior completion of, GEO 100 or GEO 113 is required.

### **GEO 102SP Earth Materials and Processes Lab 1 Credits**

This lab course introduces students to the origin, identification, and significance of geologic materials, processes, and landforms. Hands-on experiences with mineral and rock specimens, topographic and geologic maps, and GPS and other data collection techniques are emphasized, along with field trip and in-lab observations, measurements, and interpretations. One three-hour lab per week. This course counts towards the fulfillment of the Disciplinary Perspectives element of the CLAS general education curriculum.

**Prerequisite(s):** concurrent enrollment in, or prior completion of, GEO 100 or GEO 113 is required.

### **GEO 110 Geology of National Parks 3 Credits**

U.S. national parks highlight the geologic wonders of our country and provide us with some of the best examples of the many processes that initially formed our planet and those that continue to shape it. This course is an introduction to the geological setting of selected U.S. national parks. It provides an overview of geological concepts and relates the geology of each park to the processes that initially formed, and subsequently shaped, their characteristic landforms. Such processes include: plate tectonics, volcanic and plutonic activity, glaciation, cave formation, stream and coastal processes, and erosional processes. Consequently, students not only will understand how the physical geography of the U.S. varies from coast to coast, but also will connect these varied landscapes with the geologic processes that formed them and relate them to unique wildlife or vegetation in the parks studied.

### **GEO 113 Environmental Geology 3 Credits**

Examines the fundamental premise that "society exists by geologic consent subject to change without notice" by studying a number of important global geologic processes and cycles, and the hazards and/or resources they present to individuals, societies, and the natural environment. Topics discussed include earthquakes, volcanism, stream flooding, coastal erosion, global climate change, and global water, soil, mineral, and energy resources. Cost/benefit considerations, hazard mitigation concepts, economic and political ramifications, and interactions among the lithosphere, hydrosphere, atmosphere, and biosphere also are presented. The course is designed to give non-science majors a deeper appreciation and understanding of the basic scientific concepts involved, as well as individual and societal connections to the global geologic environment, leading to better, more informed business, political, policy, and personal decisions. This course counts towards the fulfillment of the Disciplinary Perspectives element of the CLAS general education curriculum.

### **GEO 168 Mesozoic Ruling Reptiles 3 Credits**

This course provides an introduction to the vertebrate groups that dominated the land (Dinosaurs), the seas (Mosasaurs, Plesiosaurs, Pliosaurus, Tylosaurus, and Ichthyosaurs) and the skies (Pterosaurs, Pterodactyls) during the Mesozoic Era (65-250 million years ago). Students study the diversity of skeletal architectures and their reconstructed function and the often controversial, inferred anatomy, physiology, reproductive strategy, habit, and social behaviors of these animals that are different from mainstream reptiles, birds, and mammals. They also learn about the paleogeographical, and paleoclimatological conditions that facilitated the evolutionary rise to dominance and diversification of these vertebrate groups and the debated causes of their eventual extinction. These topics also serve to illustrate how the scientific approach works and how competing hypotheses are evaluated. Three hours of lecture per week. Weekend field trips may be required. This course counts towards the fulfillment of the Disciplinary Perspectives element of the CLAS general education curriculum.

### **GEO 290 Directed Research and Study in Geosciences 1-4 Credits**

Directed Research and Study in Geosciences will provide an opportunity for freshman and sophomore students to gain hands-on research experience in the geosciences. This is an individual program of study and each student will work with a selected faculty member on a topic of mutual interest. The course consists of a combination of project meetings, supervised research, and guided readings. The focus will be on formulating research questions, designing and conducting experiments, collecting the necessary data, reviewing the scientific literature as it relates to each student's research topic in a weekly meetings with the instructor, and communicating the findings by writing a final project report.

### **GEO 304 Elements of Mineralogy 4 Credits**

This course examines the physical properties, chemistry, atomic structure, crystallography, uses, and environmental impacts of important minerals found in the Earth's lithosphere and biosphere. In addition, lab assignments and exercises emphasize crystal symmetry and chemistry; polarizing microscope, ICP, SEM, and x-ray analytical techniques; the graphical display and interpretation of compositional data; optical properties of isotropic and uniaxial minerals; and the identification of mineral hand specimens. Three hours of lecture and one three-hour lab per week. At least one weekend field trip required. Prerequisite(s): GEO 100 or GEO 113, and GEO 102, and CHE 120, CHE 121 taken prior or concurrently; or permission of instructor.

**Corequisite(s):** GEO 304L.

**GEO 304L Mineralogy Lab 0 Credits**

This lab is a co-requisite and must be taken with the corresponding course.

**Corequisite(s):** GEO 304.

**GEO 305 Petrology and Petrography 4 Credits**

The origin, evolution, and terrestrial distribution of igneous and metamorphic rocks are presented and detailed. Classroom lectures and discussions emphasize rock geochemistry, mineralogic variability, the constraints placed on petrogenetic models by physio-chemical studies of natural and synthetic systems, and the relation of the various rock types to current plate tectonic theory and other whole-earth processes. The laboratory emphasizes the continuing development of optical microscopy skills, the identification of rock texture and mineralogy in thin section and hand specimen, the optical determination of mineral composition, and the recognition of possible petrogenetic processes as recorded in the rocks themselves. Three hours of lecture and one three-hour lab per week. Two weekend field trips required. Prerequisite(s): GEO 304, and CHE 122 and CHE 123 or taken prior or concurrently; or permission of instructor.

**Corequisite(s):** GEO 305L.

**GEO 305L Petrology and Petrography Lab 0 Credits**

This lab is a co-requisite and must be taken with the corresponding course.

**Corequisite(s):** GEO 305.

**GEO 306 Sedimentology and Stratigraphy 4 Credits**

The principles of weathering, erosion, transportation, and deposition of sediment are the focus of this course. Sediment characteristics are examined to identify the processes involved in transporting grains and the specific environment in which the grains were deposited. Students will learn how to collect, analyze, and interpret sedimentary data and how to interpret surface and subsurface stratigraphic data using various techniques, such as lithostratigraphic, biostratigraphic, and geophysical, correlations. Field trips will expose students to different sedimentary environments and provide opportunities for students to learn how to conduct fieldwork. Three hours of lecture and one three-hour lab per week. Weekend field trips may be required. Prerequisite(s): GEO 100.

**Corequisite(s):** GEO 306L.

**GEO 306L Sedimentology and Stratigraphy Lab 0 Credits**

This lab is a co-requisite and must be taken with the corresponding course.

**Corequisite(s):** GEO 306.

**GEO 308 Mineralogy and Petrology 4 Credits**

This course examines the origin, evolution, and distribution of igneous and metamorphic rocks based on mineralogy, chemistry, and tectonic relationships. Mineral content and rock texture are used to identify and classify igneous and metamorphic rocks. The physical and chemical properties of these rocks are used to understand their tectonic setting, process of formation, and pressure-temperature conditions.

**Prerequisite(s):** GEO 100 (or GEO 113) and GEO 102.

**GEO 308L Mineralogy and Petrology Lab 0 Credits**

This is the laboratory course that accompanies GEO 308. Laboratory work consists of the identification of mineral and rock hand specimens. Microscopic analyses include the identification and interpretation of optical properties of minerals and rock textures. Field trips provide opportunities for students to examine outcrops of igneous and metamorphic rocks.

**Prerequisite(s):** GEO 100 (or GEO 113) and GEO 102.

**GEO 310 Structural Geology 4 Credits**

The origin, distinguishing characteristics, and geographic distribution of deformational structures of the Earth's crust. In the laboratory, GPS, GIS, geologic maps, and three-dimensional problems are used in the study of typical surface and subsurface geologic problems. Three hours of lecture and one three-hour lab per week. Weekday and/or weekend field trips may be required. Prerequisite(s): GEO 100 or GEO 113, GEO 102.

**Corequisite(s):** GEO 310L.

**GEO 310L Structural Geology Lab 0 Credits**

This lab is a co-requisite and must be taken with the corresponding course.

**Corequisite(s):** GEO 310.

**GEO 350 Soil and Surficial Processes 4 Credits**

This course examines the physical, chemical, hydrological, and biological aspects of soil and their relation to geomorphologic development. Specific topics include descriptions of soil texture and structures, soil classification, soil colloids, soil redox and pH, and their effect on vadose zone water chemistry. Soil genesis and erosion controls, microbiology/ecology, nutrient cycles, and modern soil pollution from sludge and pesticide applications, as well as domestic and industrial chemical spills, also are discussed. The lab portion of the course introduces the basic techniques of soil analysis, both physical and chemical, and field survey methods. Three hours of lecture and one three-hour lab per week. Prerequisite(s): GEO 100 or GEO 113, and GEO 102.

**Corequisite(s):** GEO 350L.

**GEO 350L Soil and Surficial Processes Lab 0 Credits**

This lab is a co-requisite and must be taken with the corresponding course.

**Corequisite(s):** GEO 350.

**GEO 407 Hydrology and Water Resources 4 Credits**

This course introduces the principles that govern both surface water and groundwater flows that have applications to societal water needs. Surface water topics cover the basics of the hydrologic cycle, the processes of precipitation, evapotranspiration, runoff, and infiltration, and various factors affecting water supply and water quality issues in a modern watershed. Groundwater topics examine the principles that govern flow through a porous medium and the basics of well hydraulics under different pumping conditions that community development requires. Laboratory exercises will give students hands-on experience with the delineation of watersheds, analysis of precipitation data, and flow contaminant transport modeling. The field portion of the laboratory includes runoff and stream discharge measurements, as well as hydraulic conductivity estimations from both slug and pumping tests. Three hours of lecture and one three-hour lab per week. Prerequisite(s): GEO 100 or GEO 113, GEO 102, and MTH 105 or higher.

**Corequisite(s):** GEO 407L.

**GEO 407L Hydrology and Water Resources Lab 0 Credits**

This lab is a co-requisite and must be taken with the corresponding course.

**Corequisite(s):** GEO 407.

**GEO 480 Senior Thesis 3 Credits**

A senior thesis is optional for geosciences majors. However, a senior thesis is required for eligibility to graduate with honors in geosciences. The topic for investigation will be chosen by the student in consultation with the faculty of the Department of Geological, Environmental, and Marine Sciences. The student must initiate consideration of a proposal to the Department. The proposal must contain a discussion of the proposed project and a timetable to be followed in the study. A departmental committee consisting of a major and minor advisor will evaluate the written paper submitted at the conclusion of the study or other approved venue. An oral presentation before the department at the conclusion of the semester in which the study is completed is required. Proposals must be submitted in final form no later than the end of the ninth week of the semester prior to the semester in which the study is undertaken.

**Prerequisite(s):** senior standing in the geosciences major and permission of instructor.

**GEO 490 Independent Study: Research and Creative Expression 1-4 Credits**

Immerses the student in field or laboratory research. The student learns to organize material, use the literature, make precise measurements, and obtain reproducible data. If possible, the student will publish the results or present them at a scientific meeting.

**GEO 491 Internship in Geosciences 1-4 Credits**

A supervised work experience in an approved organization where qualified students gain real-world knowledge and utilize their academic training in a professional environment. Placements may be in private, public, non-profit, or governmental organizations. These can include consulting firms, regulatory agencies, advocacy groups, and educational or research institutions. Normally, 50 hours of internship per credit is required. A mutually agreed upon method of evaluation will be formalized prior to the approval of the internship by the sponsoring faculty and could include a term paper or project report and a poster presentation.

**Prerequisite(s):** 2.5 GPA and permission of instructor.