

# GEOLOGY

## Courses

### **GEO 103. Principles of Geography. 3 Hours**

The study of spatial processes that shape the Earth's physical and cultural environment through a survey of major branches of physical and human geographic inquiry.

### **GEO 104. Biology-Geology Field Course. 3 Hours**

Fundamental earth science topics with emphasis on direct field experience. One week on campus, three weeks in the Rocky Mountains near Denver, Colorado, and one week of travel. For all non-geology and non-biology majors. Corequisite(s): BIO 104; (BIO 104L or GEO 104L).

### **GEO 104L. Biology-Geology Field Laboratory. 1 Hour**

Course to accompany GEO 104.

### **GEO 109. Earth, Environment, and Society. 3 Hours**

This course examines the complex relationship between natural geologic processes and their effects on human society. The course will examine fundamental geologic processes and associated hazards (such as earthquakes, tsunamis, volcanic eruptions, flooding) while also assessing human impacts such as pollution, energy industry and land-use planning. This course provides an opportunity to discuss, from a geologic perspective, the ramifications of and potential solutions to problems associated with utilization of Earth's resources. Laboratory optional but not required. No prerequisite.

### **GEO 109L. Earth, Environment, and Society Lab. 1 Hour**

Laboratory exercises in Earth and Environmental Science to accompany GEO 109 Lecture. Two hours each week. Prerequisite(s): (GEO 109 or GEO 115 or GEO 208 or SCI 210 – or co-req); permission of instructor.

### **GEO 115. Physical Geology. 3 Hours**

Introductory course in geologic principles and processes. Examines Earth's major systems including the solid Earth, atmosphere, hydrosphere, and cryosphere. Laboratory optional for non-majors.

### **GEO 115L. Physical Geology Laboratory. 1 Hour**

Physical Geology Lab - laboratory exercises in Physical Geology to accompany GEO 115 lecture. Prerequisite(s): (GEO 109 or GEO 115 or GEO 208 or SCI 210 – or co-req); permission of instructor.

### **GEO 116. Geological History of the Earth. 3 Hours**

Study of earth history over the last 4.6 billion years - from its origins to the present day. Includes earth origins, the development of the earth during the Precambrian including evolution of the atmosphere, and the appearance of prokaryotic and eukaryotic life. Major biological development and environmental, tectonic, and climatic changes during the last half-billion years (the Phanerozoic) will be examined, including the Pleistocene "Ice Age" and Anthropocene conditions. Prerequisite(s): (GEO 109 or GEO 115 or GEO 208 or SCI 210); permission of instructor.

### **GEO 116L. Geological History of the Earth Laboratory. 1 Hour**

Geological History of the Earth Laboratory - laboratory exercises in Historical Geology to accompany GEO 116 lecture. Corequisites: GEO 116.

### **GEO 198. Geology, Landscape & Environment of the Miami Valley. 3 Hours**

Field-based course examining the geologic history of the Miami Valley and Dayton area; processes leading to the modern landscape; the impact of human activity will be assessed. Prerequisite(s): GEO 109 or GEO 115 or permission of instructor.

### **GEO 201. Mineralogy. 3 Hours**

Introduction to crystallography, crystal chemistry and crystal structure. Study of the major groups of rock-forming minerals, their association and occurrence with emphasis on identification by physical properties and optical techniques. Prerequisites: GEO 109, GEO 115, GEO 208, or SCI 210 or permission of instructor. Corequisites: GEO 201L.

### **GEO 201L. Mineralogy Laboratory. 1 Hour**

Course to accompany GEO 201. Three hours per week. Prerequisites: GEO 109, GEO 115, GEO 208, or SCI 210. Corequisites: GEO 201.

### **GEO 202. The Inner Earth. 3 Hours**

Exploration of the Earth's internal processes of magmatism, metamorphism and deformation as part of its larger-scale processes of convection, conduction, and plate tectonics. Prerequisites: GEO 201 and GEO 201L. Corequisites: GEO 202L.

### **GEO 202L. The Inner Earth Laboratory. 1 Hour**

Laboratory course to accompany GEO 202 The Inner Earth. 3 hours per week. Prerequisites: GEO 201 and GEO 201L. Corequisites: GEO 202.

### **GEO 204. Geology for Teachers. 4 Hours**

Introduction for preservice teachers to the Earth system and the processes that operate in the atmosphere, hydrosphere, biosphere, and solid Earth. Emphasis is on understanding how interactions among these fundamental Earth systems maintain our livable planet. Students will explore the Earth system through best practices in teaching and inquiry, and through field trips. For ECE, EMS, and EMM majors only. Students completing this course may not take SCI 210. Prerequisite(s): EDT 110; SCI 190.

### **GEO 208. Environmental Geology. 3 Hours**

Environmental Geology is the study of the relationship of geologic factors to natural hazards and the problems of water supply, pollution, erosion, land use, and earth resource utilization. Laboratory optional.

### **GEO 208L. Environmental Geology Laboratory. 1 Hour**

Laboratory course to accompany GEO 208. This lab is designed to provide practical exercises that will enhance a student's understanding of how human beings interact with the geological environment. Lab activities will take an experiential, inquiry-based approach to topics relevant in past, present, and future societies. One two-hour laboratory per week concurrently run with the GEO 208 lecture course. Prerequisites: (GEO 109 or GEO 115 or GEO 208 or SCI 210 – or co-req); permission of instructor.

### **GEO 218. Geological Site Investigation for Engineers. 3 Hours**

Exploration of the principles of geological site investigation applied to land-use planning, geohazard risk analysis, and diverse engineering applications.

### **GEO 234. Energy Resources. 3 Hours**

The chemical and geological aspects of formation, production, and benefits/costs (including environmental impacts) of energy derived from fossil fuels (coal and hydrocarbons), biofuels (e.g., ethanol production), radioactive materials (nuclear power), and renewable sources (e.g., geothermal, hydro, wind, and solar power).

### **GEO 301. Structural Geology. 3 Hours**

The origin and development of structural features of the earth's crust; folding, faulting, mountain building processes, and deformational fabrics. Prerequisites: GEO 109 or GEO 115 or SCI 210 or GEO 208 or GEO 218. Corequisites: GEO 301L.

### **GEO 301L. Structural Geology Laboratory. 1 Hour**

Course to accompany GEO 301. Three hours each week. Corequisites: GEO 301.

**GEO 303. Field Geology. 6 Hours**

Field studies in Geology and Environmental Geology. This course focuses on geologic field techniques, rock outcrop description and interpretation. Current field sites include Colorado and New Zealand. Prerequisite(s): GEO 115 or GEO 109 or GEO 208 or SCI 210, or GEO 218.

**GEO 308. Problems & Decisions in Environmental Geology. 3 Hours**

An in-depth examination of selected environmental problems and the way in which scientific information guides practice and policy. Topics will range from investigations of natural hazards to considerations of land use and water resources. Prerequisites: GEO 109 or GEO 115 or GEO 208 or SCI 210.

**GEO 308L. Problems & Decisions in Environmental Geology Laboratory. 1 Hour**

Course to accompany GEO 308. Three hours each week and periodic field work.

**GEO 401. Paleontology. 3 Hours**

The study of ancient life. The morphology, ecology, evolution, and stratigraphic distributions of selected invertebrates, vertebrates, and plants.

**GEO 401L. Paleontology Laboratory. 1 Hour**

Course to accompany GEO 401. Two hours each week.

**GEO 402. Glacial Geology. 3 Hours**

The origin of mountain and continental glaciers; their depositional features, erosive activity and dynamics; history of glaciation in geologic past with special emphasis on North American Quaternary ice advances. Prerequisites: GEO 115 or GEO 109 or SCI 210 or GEO 208.

**GEO 402L. Glacial Geology Laboratory. 1 Hour**

Course to accompany GEO 402. Three hours each week.

**GEO 404. Problems in Geology. 0-3 Hours**

In this course, students will engage in faculty mentored experiential learning in Geology and Environmental Geosciences. These experiences may be related to geoscience research activity in a field or laboratory setting and course outcomes will be assessed through a final report following the experience. Prerequisites: Instructor Permission.

**GEO 407. Sculpted Planet: Geomorphology, Surface Processes, and the Origins of Earth's Topography. 3 Hours**

Detailed study of the processes shaping the Earth's surface and the landforms and deposits that they produce. Prerequisites: GEO 115 or GEO 109 or SCI 210 or GEO 208 or GEO 218.

**GEO 407L. Sculpted Planet Laboratory. 1 Hour**

Course to accompany GEO 407. Three hours each week. Corequisites: GEO 407.

**GEO 409. Surface & Groundwater Hydrology. 3 Hours**

This course is designed to provide a science or engineering student with the fundamental concepts and principles central to the study of water as a resource. This will include an examination of all components of the hydrologic cycle including surface-water hydrology and management, groundwater hydrogeology, and water resource management. Prerequisites: GEO 115 or SCI 210 or GEO 208 or GEO 109 or GEO 218 or permission of instructor.

**GEO 409L. Surface and Groundwater Hydrology Laboratory. 1 Hour**

Laboratory exercises to accompany GEO 409. Three hours per week. Corequisites: GEO 409.

**GEO 410. Stratigraphy and Sedimentology. 3 Hours**

Investigation and interpretation of sedimentary rocks, sedimentary environments, and the stratigraphic record. Prerequisites: GEO 116.

**GEO 410L. Stratigraphy and Sedimentology Laboratory. 1 Hour**

Laboratory exercises to accompany GEO 410. Three hours each week. Corequisites: GEO 410.

**GEO 411. Petrology. 3 Hours**

Study of the formation of sedimentary, igneous, and metamorphic rocks. Prerequisite(s): GEO 201.

**GEO 411L. Petrology Laboratory. 1 Hour**

Course to accompany GEO 411. Two hours each week. Prerequisite(s): GEO 201.

**GEO 412. Introductory Geochemistry. 3 Hours**

Study of elementary thermodynamics, aqueous geochemistry, and principles governing the distribution of trace elements, radioisotopes and stable isotopes in igneous, metamorphic and sedimentary rocks. Emphasis on applications and solution of geological problems. Prerequisite(s): GEO 201 or permission of instructor.

**GEO 412L. Introductory Geochemistry Laboratory. 1 Hour**

Course to accompany GEO 412. Three hours each week.

**GEO 420. The Internet of Things. 3 Hours**

Introduction to the multi-disciplinary topic of Internet of Things (IoT), a blend of engineering and science. The course begins with a fundamental technical understanding of the IoT architecture. From this foundation, students experience hands-on labs in a team environment with theoretical justification. The applied work features environmental sensor networking with geospatial data. Each surface area in IoT is explored from sensors and embedded devices to protocols and virtual servers highlighted by current trends within IoT. Lastly, the history, software and influential people will be discussed to provide class context. Ultimately, students scaffold their knowledge through a series of labs, team challenges and supporting lectures to create a final business proposal for a real client IoT value proposition. Prerequisite(s): Sophomores, Juniors, and Seniors only.

**GEO 450. Applied Geographic Information Systems. 4 Hours**

Introduction of concepts and implementation of analysis in geographic information systems (GIS).

**GEO 451. Geographic Information Systems (GIS) for Human Rights. 4 Hours**

This course introduces the concepts and implementation of analysis in geographic information systems (GIS), and applies the GIS tool to different human rights situations or investigations. This course is cross-listed with HRS 451 and GEO 551.

**GEO 455. Environmental Remote Sensing. 4 Hours**

Introduction to principles and concepts of remote sensing, a sophisticated technology of earth observation that provides fundamental data for global environmental investigation.

**GEO 477. Honors Thesis Project. 3 Hours**

First of two courses leading to the selection, design, investigation, and completion of an independent, original Honors Thesis project under the guidance of a faculty research advisor. Restricted to students in the University Honors Program with permission of the program director and department chairperson. Students pursuing an interdisciplinary thesis topic may register for three semester hours each in two separate disciplines in consultation with the department chairpersons. Prerequisite(s): Approval of University Honors Program.

**GEO 478. Honors Thesis Project. 3 Hours**

Second of two courses leading to the selection, design, investigation, and completion of an independent, original Honors Thesis project under the guidance of a faculty research advisor. Restricted to students in the University Honors Program with permission of the program director and department chairperson. Students pursuing an interdisciplinary thesis topic may register for three semester hours each in two separate disciplines in consultation with the department chairpersons. Prerequisite(s): Approved 477; approval of University Honors Program.

**GEO 479L. Environmental Instrumentation Laboratory. 3 Hours**

This is a field-based course designed for students majoring in the sciences. A significant portion of this course focuses on experiential learning in the field and laboratory. Students will learn the use of field and laboratory-based equipment to study current environmental issues. Emphasis is placed on team-centered approaches to investigating environmental problems. Prerequisites: GEO 115 or SCI 210 or GEO 109 or GEO 208 or GEO 218 or by permission of instructor.

**GEO 480. Senior Capstone Project & Presentation. 3 Hours**

Project and presentation in the scholarship, activity and/or practice related to the major. Students will present their work in a forum appropriate to the major.

**GEO 485. Geographic Information Systems Applications in Water Resources Planning & Management. 4 Hours**

An introduction to GIS applications in water resource management. Following an introduction to GIS basics, this course focuses on GIS techniques in surface water modeling and floodplain delineation and management.

**GEO 495. Geology Seminar. 1 Hour**

Introduction to professional practices in the geosciences. Students will attend seminar talks by guest speakers, research career options and graduate programs in the earth sciences, develop a professional resume, and participate in other profession-building activities. May be repeated. Prerequisite(s): Permission of instructor.

**GEO 498. Geological Research and Thesis. 3 Hours**

Research project within an area of the geological sciences, including, but not limited to, environmental geology, geochemistry, geomorphology, or paleontology. The results are to be presented in a written thesis. Prerequisite(s): Permission of Instructor.

**GEO 502. Glacial Geology. 3 Hours**

The origin of mountain and continental glaciers; their depositional features, erosive activity and dynamics; history of glaciation in geologic past with special emphasis on North American Quaternary ice advances. Prerequisites: GEO 115 or GEO 109 or SCI 210 or GEO 208 or GEO 218.

**GEO 502L. Glacial Geology Laboratory. 1 Hour**

Course to accompany GEO 502. Three hours each week.

**GEO 507. Sculpted Planet: Geomorphology, Surface Processes and the Origins of Earth's Topography. 3 Hours**

Detailed study of the processes shaping the Earth's surface and the landforms and deposits they produce. This course is co-listed with GEO 407, and students taking this course will be given supplemental work and responsibilities, including additional or alternative exams, research and leadership roles during group projects. Prerequisites: GEO 115 or GEO 109 or SCI 210 or GEO 208 or GEO 218.

**GEO 507L. Sculpted Planet Laboratory. 1 Hour**

Course to accompany GEO 407. Three hours each week. This course is co-listed with GEO 407L, and students taking this course will be given supplemental work and responsibilities, including additional or alternative exams, research and leadership roles during group projects.

**GEO 509. Advanced Surface & Groundwater Hydrology. 3 Hours**

This course is designed to provide a graduate-level science or engineering student with the fundamental concepts and principles central to the study of water as a resource. This will include an examination of all components of the hydrologic cycle including surface-water hydrology and management, groundwater hydrogeology and water resource management. This course is co-listed with GEO 409, and students taking this course will be given extra assignments such as developing a report of groundwater flow analysis for an aquifer. Prerequisites: GEO 115 or SCI 210 or GEO 208 or GEO 109 or GEO 218 or permission of instructor.

**GEO 509L. Advanced Surface and Groundwater Hydrology Laboratory. 1 Hour**

Laboratory exercises to accompany GEO 409. Three hours per week. This course is co-listed with GEO 409L, and students taking this course will be given extra assignments.

**GEO 510. Stratigraphy and Sedimentology. 3 Hours**

Investigation and interpretation of sedimentary rocks, sedimentary environments and the stratigraphic record. This course is co-listed with GEO 410, and students taking this course will be given extra assignments during the semester and will be assignment a class project accompanied with an oral or poster presentation at the end of the semester. Prerequisites: GEO 109 or GEO 115 or GEO 208 or GEO 218 or equivalent.

**GEO 510L. Stratigraphy and Sedimentology Laboratory. 1 Hour**

Investigation and interpretation of sedimentary rocks, sedimentary environments and the stratigraphic record. This course is co-listed with GEO 410, and students taking this course will be given extra assignments during the semester and will be assignment a class project accompanied with oral or poster presentation at the end of the semester.

**GEO 512. Introductory Geochemistry. 3 Hours**

Study of elementary thermodynamics, aqueous geochemistry, and principles governing the distribution of trace elements, radioisotopes and stable isotopes in igneous, metamorphic and sedimentary rocks. Emphasis on applications and solution of geological problems. This course is co-listed with GEO 412, and students taking this course will be given extra assignments and article reading during the semester and will be assignment a class project accompanied with oral or poster presentation at the end of the semester. Prerequisites: GEO 201 or permission of instructor.

**GEO 512L. Introductory Geochemistry Laboratory. 1 Hour**

Course to accompany GEO 512 and co-listed with GEO 412 L. The class meet three hours a week. The lab extends the basic geochemical principles and concepts discussed in GEO 512 and provide hands on experience in the lab. The labs covers scientific methodology, analytical techniques, data analysis and interpretation, and applying geochemical principles to geological problems. In addition, the lab introduces geochemical softwares. Other skills you will learn are independent thinking and self-motivation.

**GEO 550. Applied Geographic Information Systems. 4 Hours**

This course covers the fundamentals of Geographic Information Systems (GIS) technology and how it is being applied in such diverse fields as physical sciences, social/political sciences, planning, marketing, health, criminal justice, natural resources, and engineering. Students will learn the processes to collect, organize, analyze and display geographic data obtained from sources such as address geocoding, GPS, CD-ROM and World Wide Web sites. However, the emphasis of the course will be on data preparation and visualization based on sound knowledge of basic principles of cartographic design. Some preliminary data analysis techniques will be introduced but it is not an emphasis of the course. Each student will complete a series of mini projects that illustrate the typical steps in a GIS project. Major topics include: representation of geography, coordinate systems and map projections, principles of basic cartography, thematic mapping, data acquisition using GPS, geocoding, basic editing, and basic data management and exploration.

**GEO 551. Geographic Information Systems (GIS) for Human Rights. 4 Hours**

This course introduces the concepts and implementation of analysis in geographic information systems (GIS), and applies the GIS tool to different human rights situations or investigations. This course is cross-listed with GEO 451 and HRS 451, and it is a CAP-approved course for undergraduate level, we would like to make this course available for graduate students.

**GEO 555. Environmental Remote Sensing. 4 Hours**

Introduction to principles and concepts of Remote Sensing, a sophisticated technology of earth observation that provides fundamental data for global environmental investigation.

**GEO 560. Advanced Applications of Geographical Information Systems. 3 Hours**

Building upon GEO 450 / GEO 550, this course aims to broaden students' understanding of GIS theories and emphasize advanced spatial analysis, modeling and visualization methodologies. Based on an applied approach, this course will use a variety of projects to illustrate these techniques. Prerequisite(s): GEO 450 / GEO 550 Applied GIS.

**GEO 585. Geographic Information Systems Applications in Water Resource Planning & Management. 4 Hours**

This course introduces GIS applications in water resource management. Following an introduction to raster-based modeling in GIS, it will focus on GIS techniques in surface water modeling and floodplain delineation and management.

**GEO 598. Capstone Project. 3 Hours**

This capstone course aims to integrate concepts and capabilities developed in previous courses (GEO 450 / GEO 550 and GEO 560) and to apply them in a realistic setting relevant to individual student interests. The course seeks to refine skills in project implementation using GIS, emphasizing project development, organization and management, presentation technique, and the use of modern information-acquisition and processing technology in GIS and/or Remote Sensing. Prerequisite(s): GEO 450 / GEO 550 Applied GIS; GEO 560 Advanced GIS.