

# GEO

## Geosciences

### GEO 101 - E: Environmental Geology

Fundamental earth science concepts are used to assess the impact of increasing global population and development on earth's natural resources and also to examine how natural processes affect human activities. Topics include water usage and pollution, soil pollution and erosion, radioactive and solid waste disposal, landslides, stream flooding, coastal erosion, environmental consequences of energy and mineral resource utilization, acid rain, global climate change, and the environment effects on human health. Aspects of environmental geology that are particularly applicable to Long Island and metropolitan New York are emphasized.

3 credits

### GEO 102 - E: The Earth

A summary of the processes that have shaped the earth and the other terrestrial planets as inferred from study of their surface materials, structural features, and interiors. Topics include the earth in the solar system; earth materials and rock-forming processes; surface processes and their bearing on human activities; crustal deformation and global tectonics; the earth's interior; and the geological features, compositions, and evolution of the terrestrial planets.

3 credits

### GEO 103 - E: The Earth Through Time

The history of the earth from its formation 4.5 billion years ago to the present. Major issues to be addressed include formation and early history of the earth and moon; evolution of continents, oceans, and atmosphere within the framework of plate tectonics; origin of life; and evidence of past climates.

3 credits

### GEO 105 - E: Energy Resources for the 21st Century

Today we are faced with the challenge of driving the economies of modern civilization with new energy resources. This course looks at the current energy sources to assess their long term sustainability. In particular, this course examines fossil fuels, from the geologic processes that create them through their utilization. This course evaluates the impact on the global environment and the finiteness of each resource. Nuclear, geothermal, solar, wind, hydro, tidal, and other energy sources will be evaluated. This course projects

forward to anticipate needs and evaluate future resources for time scales of 10, 20, 50, and 100 years. It identifies the technical advances that are required to meet the future energy needs. The emphasis of the course is to provide a vision of the current global energy setting. It develops tools that enable critical thinking on issues that interface society and science. Homework assignments will use the internet for accessing relevant information and spread sheets (such as Excel) and Google Earth to evaluate this information.

3 credits

### GEO 106 - E: Planetary Geology

Geology and geological history of the terrestrial planets, planetary satellites and minor bodies of the solar system are evaluated. Whenever possible, emphasis will be placed on geological results from the most recent planetary missions. Among the main topics to be considered are meteorites and the origin of terrestrial planets, the internal structure of terrestrial planets, planetary volcanism, planetary stratigraphy, surface processes such as meteorite impacts, wind and weathering, minor bodies of the solar system and the origin of the solar system. Not for credit in addition to AST 105 or AST 205.

*Advisory Prerequisite: High School Earth Science*

3 credits

### GEO 107 - E: Natural Hazards

An introduction to the concepts, techniques, and scientific methods used in the earth sciences. The natural hazards posed by earthquakes and volcanic eruptions are used as a focus. These phenomena are examined in the context of the theory of plate tectonics to determine their cause, destructive potential, and the possibility of predicting and controlling their occurrence. Elementary probability methods are introduced in the treatment of approaches to prediction. Societal responses to forecasts are also considered.

3 credits

### GEO 112: Physical Geology Laboratory

Rock and mineral identification, introduction to topographic and geologic maps.

*Pre- or Corequisite: GEO 102*

1 credit

### GEO 113: Historical Geology Laboratory

An introduction to basic techniques used for interpreting geological history. Topics include interpretation of topographic and geological maps and cross sections, introduction to

fossils, and basic stratigraphic techniques. One three-hour laboratory per week.

*Pre- or Corequisite: GEO 103*

1 credit

### GEO 121: Principles of Geology

Course offered in conjunction with Sayville High School.

4 credits

### GEO 287: Introductory Research in Geology

Independent research, under the supervision of a faculty member, at a level appropriate to lower-division students. May be repeated once.

*Prerequisites: U1 or U2 standing; one GEO course; permission of instructor and departmental research coordinator*

0-3 credits, S/U grading

### GEO 301 - H: Sustainability of the Long Island Pine Barrens

The ecologically diverse Long Island Pine Barrens region provides a habitat for a large number of rare and endangered species, but faces challenges associated with protection of a natural ecosystem that lies in close proximity to an economically vibrant urban area that exerts intense development pressure. In this course we will consider the interaction of the ecological, developmental and economic factors that impact the Pine Barrens and the effectiveness of decision support systems in promoting sustainability of the Pine Barrens. This course is offered as BIO 301, GEO 301, ECO 301, ENV 301, and ESG 301.

*Prerequisites: U3 or U4 status and one of the following: BIO 201, CHE 131, ECO 108, ESG 100, ESG 198, GEO 101, GEO 102*

3 credits

### GEO 303: Geology of the Turkana Basin

Field course that applies fundamental geological concepts to the sediments and rock units in the Turkana Basin, Kenya, to provide a foundation for the chronology and context for recorded events in human evolution. Emphasis is given to sedimentation, stratigraphy, volcanism, and tectonics, as they apply to local geology, including training in field methods. Modern terrestrial processes and landscape evolution are examined using features present in the Turkana Basin. Consideration is also given to broader geologic events spanning the Oligocene to the present. Geologic concepts are linked to modern and ancient environments, archaeology, and paleoanthropology in northern Kenya.

*Prerequisite: Permission of the instructor/ Study Abroad office*

*Advisory Prerequisite: GEO 103 and GEO 113*  
3 credits

### **GEO 304 - H: Energy, Mineral Resources, and the Environment**

A survey of the origin, distribution, and importance to modern civilization of the fuels and minerals won from the earth. Geology of mineral resources and problems of finding, extracting, and supplying fossil fuels, metallic ores, water, and non-metallic commodities to industry and community as well as the ultimate limits of their abundances. Environmental concerns related to the exploitation of mineral resources with review of legislation and other steps being taken to minimize environmental damage.

*Prerequisite: One DEC E course*

3 credits

### **GEO 305: Field Geology**

Geological field studies on and near the Stony Brook campus. Labs emphasize mapping techniques and field studies of glacial and environmental geology, and include geophysical and hydrological analyses and mapping. Course consists of two three-hour sessions per week, divided between lecture and outdoor labs.

*Prerequisites: GEO 102/112 or GEO 112 and 103 and 113 or GEO 112 and 101 and 111*

3 credits

### **GEO 306: Mineralogy**

Topics include basic crystallography, crystal chemistry, and identification of the important rock-forming and ore minerals. Included are the fundamentals of optical crystallography: indices of refraction, isotropic, uniaxial, and biaxial minerals; optical indicatrix theory and interference figures. Laboratory exercises involve work with crystallographic models, mineral samples, refraction oils and the polarizing light microscope. Three hours of lecture and one three-hour laboratory per week.

*Prerequisites: GEO 102 and 112; CHE 131*

4 credits

### **GEO 307 - H: Global Environmental Change**

An analysis of the physical, chemical, and biological processes in the atmosphere, hydrosphere, lithosphere, and biosphere that are susceptible to change either from natural or anthropogenic causes. In addition to focusing on the processes, this course will examine the spatial/temporal scales of environmental changes, their consequences to systems including our economic, political, and social systems, and will consider our responsibility

and capability in managing systems in a sustainable way. This course is offered as both ENV 304 and GEO 307.

*Prerequisites: SBC 111, or SBC 113, or ENS 101, or GEO 101, or GEO 102; ENV 115 or CHE 131*

3 credits

### **GEO 309: Structural Geology**

Principles of structural geology, including classification, criteria for recognition, and mechanics of formation of crustal structural features. Elementary concepts of rock mechanics. Discussion of important tectonic features of the continents and oceans. Accompanying laboratory to cover map interpretation and algebraic and graphical solutions of structural problems. Three hours of lecture and one three-hour laboratory per week. A two-day weekend field trip visits "classic" structural localities in the East. This course has an associated fee. Please see [www.stonybrook.edu/coursefees](http://www.stonybrook.edu/coursefees) for more information.

*Prerequisites: GEO 122, or GEO 102 and 112; one semester of calculus; PHY 121/123 or 131/133 or 141 or PHY 125 and 126*

4 credits

### **GEO 310: Introduction to Geophysics**

An introduction to theoretical and applied geophysics. Topics in global geophysics include seismology, gravity, geomagnetics and heat flow, with applications to the structure and dynamics of the earth's interior. Students conduct computer-based analysis of geophysical data, some of which they collect using techniques of geophysical exploration and environmental geology. Three hours of lecture per week, plus group field experiments and analysis.

*Prerequisites: MAT 127 or 132 or 142 or 171 or AMS 161; GEO 122, or GEO 102 and 112; PHY 122/124 or 132/134 or 142, or PHY 126 and 127*

3 credits

### **GEO 311 - H: Geoscience and Global Concerns**

An exploration of how technologically-based problems facing the United States and the world are related to the basic scientific principles that explain the properties of the lithosphere, hydrosphere, and atmosphere. The set of issues include such geoscience-based topics as global warming, fossil fuel resources, nuclear waste disposal, and earthquake prediction and preparedness.

*Prerequisite: GEO 101 or 102 or 107 or 122*

3 credits

### **GEO 312: Structure and Properties of Materials**

This course will explore materials from the viewpoint of their structure and chemistry and how these affect applications. We will discuss different states matter (crystals, quasicrystals, glasses, liquids) and their similarities and differences, focusing on the crystalline state. Nanomaterials and their peculiarities in terms of structure and properties will also be considered. Particular attention will be paid to (1) Materials for energy and environment applications, (2) materials for technological applications, and (3) Earth- and planet-forming materials.

*Advisory Prerequisite: CHE 131 or PHY 131*

3 credits

### **GEO 313 - H: Understanding Water Resources for the 21st Century**

A survey of the world's water resources and the fundamental processes and concepts that govern their distribution and resupply. Topics to be covered include processes in the hydrologic cycle, water resource supply and demand, water quality, and societal aspects relating to drinking water, and industrial and agricultural water usage. Consideration is given to global water shortages, projected impacts of climate change, water-based conflict, water resource management, and conservation practices. Detail will be devoted to pollution sources, water quality standards, drinking water treatment, and government regulation. Local water issues will also be addressed.

*Prerequisite: One DEC E course*

3 credits

### **GEO 315: Groundwater Hydrology**

Physical and chemical principles of geohydrology. Concepts of groundwater geology. Introduction to quantitative models of regional fluid flow and groundwater contamination. Groundwater and geologic processes, with examples from tectonics, petroleum geology, geothermics, and economic mineralization.

*Prerequisites: GEO 102 or GEO 122; MAT 127 or MAT 132 or MAT 142 or MAT 171 or AMS 161*

3 credits

### **GEO 316: Geochemistry of Surficial Processes**

Chemical principles used in the study of surface and near-surface water, rocks, and soils. Application of equilibrium concepts and reaction rates to reactions involving gases, fluids, and minerals in nature. Consideration of soil properties and processes.

*Prerequisites:* GEO 122, or 102 and 112; CHE 132 or 142

4 credits

### **GEO 318: Engineering Geology and Coastal Processes**

Fundamental concepts of soil, sediment, and rock mechanics and the physics of surficial processes. Application is made to problems of geotechnical and coastal engineering. Topics include consolidation, loose boundary hydraulics, slope stability, underground excavations and beach and tidal inlet stability, and channel sedimentation. This course is offered as both GEO 318 and MAR 318.

*Prerequisites:* GEO 122 or GEO 102 and 112; MAT 127 or 132 or 142 or 171 or AMS 161

3 credits

### **GEO 320 - E: Glacial Geology**

History of glaciation on earth; formation and dynamics of glaciers and ice sheets; processes of glacial erosion and deposition; and the nature of glacial sediments and landforms particularly relating to the development of Long Island.

*Prerequisite:* GEO 102 or 122

3 credits

### **GEO 330: The Geology of Mars**

Overview of Mars as a planetary system. Evolution of the planet and its atmosphere through time. Detailed discussion of processes that have shaped the martian surface, including erosion, sedimentation, volcanism, impact cratering, physical and chemical weathering. Comparison of geologic processes on Mars and Earth. Discussion of past and future spacecraft missions to Mars.

*Prerequisite:* GEO 102 or GEO 122 or GEO 106

*Advisory Prerequisite:* GEO 112

3 credits

### **GEO 347: Remote Sensing**

An introduction to the fundamental principles of remote sensing, with emphasis on geological and environmental applications. Discussion of the physical basis for remote sensing techniques. Survey of commonly used sensors and image analysis methods in earth sciences. Participants gain practical experience in geologic and environmental analysis using satellite imagery.

*Prerequisite:* GEO 102 or GEO 106 or GEO 122

3 credits

### **GEO 403: Sedimentation and Stratigraphy**

The history and practice of defining units of layered rocks and interpreting their spatial relationships. Topics include the basis for the geologic time scale, lithostratigraphic versus chronostratigraphic units, biostratigraphy, magnetostratigraphy, facies patterns and Walther's Law, subsurface stratigraphy, and the application of stratigraphy to geological problems. Laboratory emphasizes practical techniques in stratigraphy. This course has an associated fee. Please see [www.stonybrook.edu/coursefees](http://www.stonybrook.edu/coursefees) for more information.

*Prerequisite:* GEO 306

*Corequisite:* GEO 401

4 credits

### **GEO 405: Field Camp**

A field course that may be taken at any one of several approved university field stations.

*Prerequisites:* Two upper-division GEO courses

1-6 credits

### **GEO 407: Igneous and Metamorphic Petrology**

Topics focus on the processes that govern the formation and distribution of igneous and metamorphic rocks and their link to the Earth's mantle, crust, and tectonic regimes. Emphasis will be placed on integrating assessment of the chemical control on compositional diversity through phase diagrams with the study of natural rock suites through hand sample and thin section analysis. Three hours of lecture and one three-hour laboratory per week.

*Prerequisite:* GEO 306

4 credits

### **GEO 420: Environmental Analysis Using Remote Sensing and Geographic Information Systems**

The use of aerial and satellite imagery in environmental analysis and the manipulation of geographic data sets of all types using Geographic Information Systems. Concentrating on Long Island, each student designs and completes a research project on a particular section of the area, focusing on the habitats of local wildlife, the locations of archaeological sites, coastal regimes, etc. Students should expect to spend approximately 10 hours per week beyond regularly scheduled classes in a University computer laboratory. This course is offered as both ANT 420 and GEO 420.

*Prerequisite:* Upper-division course in ANT or BIO or GEO or MAR

4 credits

### **GEO 447: Senior Tutorial in Geology**

Independent readings in advanced topics. May be repeated once.

*Prerequisites:* Permission of instructor and chairperson

1-3 credits

### **GEO 448: Geosciences Colloquium**

Every semester, the Department of Geosciences hosts a colloquium series. The series features weekly lectures covering a wide variety of geosciences research topics. The purpose of this course is to expose upper division geoscience students to current research being performed at Stony Brook University and elsewhere. May be repeated up to a limit of 3 credits.

*Prerequisite:* U3 or U4 status as a GEO or ESS major; Permission of Instructor

1 credit

### **GEO 475: Undergraduate Teaching Practicum I**

Work with a faculty member as an assistant in one of the faculty member's regularly scheduled classes. The student is required to attend all the classes, do all the regularly assigned work, and meet with the faculty member at regularly scheduled times to discuss the intellectual and pedagogical matters relating to the course.

*Prerequisite:* U4 standing; previous preparation in subject field; interview; permission of instructor

3 credits, S/U grading

### **GEO 476: Undergraduate Teaching Practicum II**

Work with a faculty member as an assistant in one of the faculty member's regularly scheduled classes. Students assume greater responsibility in such areas as leading discussions and analyzing results of tests that have already been graded. Students may not serve as teaching assistants in the same course twice.

*Prerequisite:* GEO 475; previous preparation in subject field; interview; permission of instructor and department

3 credits, S/U grading

### **GEO 487: Senior Research in Geology**

Under the supervision of a faculty member, a major in the department may conduct research for academic credit.

*Prerequisites:* Permission of instructor and chairperson

0-6 credits

### **GEO 488: Internship**

Participation in local, state, or national private enterprises, public agencies, or nonprofit institutions. May be repeated to a limit of 6 credits.

*Prerequisites: Permission of instructor and department*

*0-6 credits, S/U grading*