

GEOSCIENCES

GEO 101 Introduction to Earth Processes and History (4 Credits)

Geology is a study of the Earth. In this course, students will examine the processes that formed the Earth and that have continued to change the planet during its 4.57 billion year history. In rocks, minerals and the landscape, geologists see puzzles that tell a story about Earth's past. In this course, students will develop their geologic observation skills. Together, the class will investigate the origins of minerals and rocks and the dynamic processes that form volcanoes, cause earthquakes, shape landscapes, create natural resources, and control the climate—today as well as during the Earth's past. Students learn to view the Earth with a new perspective and appreciate how the planet is constantly changing, even if at extremely slow rates. Students planning to major in geosciences should take GEO 102 concurrently. {N}

Fall

GEO 102 Exploring the Local Geologic Landscape (2 Credits)

The Connecticut Valley region is rich with geologic features that can be reached by a short van ride from Smith. This is a field-based course that explores geology through weekly trips and associated assignments during which we examine evidence for volcanoes, dinosaurs, glaciers, rifting continents and Himalayan-size mountains in Western Massachusetts. Students who have taken FYS 103 are not eligible to take GEO 102. This class, when taken in conjunction with any other 100-level course, can serve as a pathway to the Geoscience major. Preference given to students taking GEO 101 concurrently and students who have previously taken a Geoscience course. Enrollment limited to 17. {N}

Fall

GEO 104 Global Climate Change: Exploring the Past, the Present and Options for the Future (4 Credits)

This course seeks to answer the following questions: What do we know about past climate and how do we know it? What causes climate to change? What have been the results of relatively recent climate change on human populations? What is happening today? What is likely to happen in the future? What choices do we have?. {N}

Fall, Spring, Annually

GEO 106 Extraordinary Events in the History of Earth, Life and Climate (4 Credits)

A journey through the 4.6 billion-year history of global change, with a focus on extraordinary events that have shaped the evolution of Earth and life through time. These events include the earliest development of life, the buildup of oxygen in the atmosphere, the devastation of the living world by catastrophic mass extinctions, the tectonic rearrangement of continents, the alternation of ice ages and eras of extreme warmth, and the evolution of modern humans. We also examine ways in which humans are changing our climatic and biologic environment and discuss potential consequences for the future of our planet. {N}

Fall, Spring, Variable

GEO 108 Oceanography: An Introduction to the Marine Environment (4 Credits)

An introduction to the global marine environment, with emphasis on the carbon cycle, seafloor dynamics, submarine topography and sediments, the nature and circulation of oceanic waters, ocean-atmosphere-climate interactions and global climate change, coastal processes, marine biologic productivity, and issues of ocean pollution and the sustainable utilization of marine resources by humans. At least one required field trip. {N}

Spring

GEO 150/ ENV 150 Mapping our World: An Introduction to Geographic Information Systems (4 Credits)

Offered as GEO 150 and ENV 150. A geographic information system (GIS) enables data and maps to be overlain, queried and visualized in order to solve problems in many diverse fields. This course provides an introduction to the fundamental elements of GIS and applies the analysis of spatial data to issues in geoscience, environmental science and public policy. Students gain expertise in ArcGIS—the industry standard GIS software—and online mapping platforms, and carry out semester-long projects in partnership with campus offices or local conservation organizations. Enrollment limited to 20. {N}

Fall

GEO 201 Colloquium: Earth History (1 Credit)

This course will involve reading a series of papers on the diverse record of life, ranging from Snowball Earth ~720 million years ago to the aftermath of one of Earth's largest mass extinctions ~250 million years ago. The sections we will focus on are preserved in Death Valley and adjacent areas. The goals of this class are to familiarize students with the vast record of Earth History preserved in the western US through a series of focused readings and an optional field trip. Prerequisites: One GEO course. Enrollment limited to 15. (E) {H}{N}

Fall, Spring, Variable

GEO 221 Mineralogy (5 Credits)

A project-oriented study of minerals and the information they contain about planetary processes. The theory and application to mineralogic problems of crystallography, crystal chemistry, crystal optics, x-ray diffraction, quantitative x-ray spectroscopy and other spectroscopic techniques. The course normally includes a weekend field trip to see minerals in the field. Prerequisite: GEO 101 and GEO 102; GEO 108; FYS 103; or GEO 102 with any other GEO 100-level course. GEO 102 can be taken concurrently. Recommended: CHM 111 or equivalent. Enrollment limited to 18. {N}

Fall

GEO 222 Petrology (5 Credits)

An examination of typical igneous and metamorphic rocks in the laboratory and in the field in search of clues to their formation. Lab work emphasizes the microscopic study of rocks in thin sections. The course normally includes a weekend field trip (e.g. Cape Ann or Vermont) which is an important part of the course. Prerequisite: GEO 221. Enrollment limited to 18. {N}

Spring

GEO 223 Geology of Active Volcanoes (1 Credit)

A field-based course to examine volcanic materials and processes at locations with active volcanoes, such as Oregon, Hawaii, Costa Rica, Iceland and Italy. Discussions include eruptive styles and cycles; magmatic evolution; lava fountains, flows, lakes, and tubes; normal faulting; crater formation; landscape development; and destruction. Participants must be physically fit and prepared for considerable hiking in rough terrain. Prerequisites: completion of an introductory level geology course. Preference given to Geosciences majors. Enrollment limited to 15. Instructor permission required. {N}

Fall, Spring, Variable

GEO 231 Invertebrate Paleontology and the History of Life (5 Credits)

A study of the major evolutionary events in the history of life, with a special focus on marine invertebrates. Special topics include evolution, functional adaptations, paleoenvironments, the origin of life, mass extinction and origination, and how life has changed through time. At least one weekend field trip. Prerequisite: GEO 101 and GEO 102; GEO 108; FYS 103; or GEO 102 with any other GEO 100-level course. GEO 102 can be taken concurrently; open also to students who have fulfilled the basis for the BIO major. Enrollment limited to 18. {N}

Fall

GEO 232 Sedimentary Geology (5 Credits)

A project-oriented study of the processes and products of sediment formation, transport, deposition and lithification. Modern sediments and depositional environments of the Massachusetts coast are examined and compared with ancient sedimentary rocks of the Connecticut River Valley and eastern New York. Field and laboratory analyses focus on the description and classification of sedimentary rocks, and on the interpretation of their origin. The results provide unique insights into the geologic history of eastern North America. Two weekend field trips. Prerequisites: GEO 101 and GEO 102; GEO 108; or GEO 102 with any other GEO 100-level course. GEO 102 can be taken concurrently. Enrollment limited to 22. {N}

Fall

GEO 241 Structural Geology (5 Credits)

The study and interpretation of rock structures with emphasis on the mechanics of deformation, behavior of rock materials, methods of analysis and relationship to plate tectonics. Laboratories involve computer-based analysis of the map patterns of geologic structures, the mechanics of their formation and field trips during the lab period to connect local examples of structures to New England tectonics. Prerequisite: GEO 101 and GEO 102, or GEO 108, or FYS 103, or GEO 102 with any other GEO 100-level course. Enrollment limited to 20. {N}

Spring

GEO 251 Geomorphology (5 Credits)

The study of landforms and their significance in terms of the processes that form them. Selected reference is made to examples in the New England region and the classic landforms of the world. During the first part of the semester laboratories involve learning to use geographic information system (GIS) software to analyze landforms. During the second part of the semester laboratories include field trips to examine landforms in the local area. Prerequisite: GEO 101, GEO 102, GEO 108 or FYS 103. Enrollment limited to 18. {N}

Spring

GEO 301 Aqueous Geochemistry (5 Credits)

This project-based course examines the geochemical reactions between water and the natural system. Water and soil samples collected from a weekend field trip serve as the basis for understanding principles of pH, alkalinity, equilibrium thermodynamics, mineral solubility, soil chemistry, redox reactions, acid rain and acid mine drainage. The laboratory emphasizes wet-chemistry analytical techniques. One weekend field trip. Prerequisites: One geoscience course and (CHM 108 or CHM 111). Enrollment limited to 16. {N}

Spring

GEO 302 Field Studies of the Desert Southwest (5 Credits)

This field-oriented course examines the diverse stratigraphic record of mass extinction and Snowball Earth as well as structural complexities preserved in Death Valley and adjacent areas. A required week-long field trip takes place in January followed by a semester-long course in the spring semester. Field analyses include measuring stratigraphic sections and field mapping. Prerequisites: GEO 231 or GEO 232 or GEO 241. Enrollment limited to 10. Instructor permission required. {N}

Fall, Spring, Variable

GEO 309 Groundwater Geology (5 Credits)

A study of the occurrence, movement and exploitation of water in geologic materials. Topics include well hydraulics, groundwater chemistry, the relationship of geology to groundwater occurrence, basin-wide groundwater development and groundwater contamination. A class project involves studying a local groundwater problem. Prerequisites: (GEO 101, 102, 108 or FYS 103) and MTH 111. Enrollment limited to 14.

Fall, Spring, Alternate Years

GEO 311 Modeling the Earth: Data Analysis in the Geosciences (4 Credits)

Major advances in our understanding of Earth's physical processes have been made through analysis and interpretation of datasets, including precise tracking of plate tectonic motions, the rate and significance of modern climate change and sea level rise, and the timing and environmental conditions of extraordinary events in Earth history. This course introduces programming and analysis skills using Python to import, query, model, and visualize geoscience datasets, with applications drawn from seismology, climate change, hydrology, and geochemistry. Prerequisite: GEO 101, GEO 102, GEO 104, GEO 106, GEO 108, GEO 112, a GEO-based FYS or permission of the instructor. Enrollment limited to 20. {M}{N}

Fall, Spring, Alternate Years

GEO 334 Carbonate Sedimentology (5 Credits)

Students in this class engage in detailed studies of the formation of carbonate sediments and rocks through participation in a required 7-10 day field trip to one of the modern tropical carbonate-producing environments (such as the Bahamas) during January interterm, followed by semester-long research projects based on the data and specimens collected in the field. Students present their results at Celebrating Collaborations in April. Class discussion topics include the history of carbonate rocks from the Precambrian to the present. Prerequisite: GEO 231 or GEO 232. Enrollment limited to 8. Instructor permission required. Interested students should contact the course instructor. Students are responsible to partially cover expenses associated with the January trip. {N}

Fall, Spring, Variable

GEO 341 Seminar: Advanced Studies in Geobiology (4 Credits)

This seminar course will examine the record of life with an approach from a geobiological perspective. We will examine the interactions between life and the environment from the early Earth through to the Modern. We will explore microbial metabolisms, isotopic systems, and their interrelated nature from the Proterozoic to the Recent. We will read recent peer-reviewed papers from the literature to inform our class discussions, and students will present material in class. Prerequisites: GEO 221 or 231. BIO majors could be admitted by permission of instructor. Enrollment limited to 12. Juniors and seniors only. Instructor permission required. {H}{N}

Fall, Spring, Variable

GEO 361 Tectonics (4 Credits)

A broadly-based examination of tectonics, the unifying theory of geology. The class discusses lithospheric plate movements, the creation and destruction of Earth's crust, the formation of mountain belts and sedimentary basins, the dynamic coupling of crust and mantle, and how these processes have shaped the Earth through time. Emphases includes critical reading of the primary literature, communication of scientific ideas orally and in writing and the central role of tectonics in uniting diverse fields of geology to create a cogent picture of how the Earth works. Prerequisite: any two 200-level courses in geosciences, one of which may be taken concurrently. {N}

Fall

GEO 399 Research Practicum in Earth History: Inquiry and Collaboration Through Research (4 Credits)

Collaboration is at the heart of nearly all scientific inquiry. This course will enable students to engage with the learning sciences on the art of collaboration, teamwork, and problem-solving through the pursuit of independent research projects in Paleontology, Earth History and Geobiology. This course will marry the state of the art on collaborative work through readings and participation in workshops on collaboration while allowing students to pursue their own independent research projects. Some goals of this class will be to 1) develop a frame for how scientists build expertise through collaboration; 2) develop skills in team building and problem solving; 3) develop lab research skills and expertise in project design; 4) gather and interpret data in support of a research project; 5) present the data in a poster presentation; 6) work towards writing a peer-reviewed and collaborative publication. May be repeated once for credit. Instructor permission required.

Fall, Spring, Annually

GEO 400 Advanced Work or Special Problems in Geosciences (1-4 Credits)

Admission by permission of the department. Proposals must be submitted in writing to the project director by the end of the first week of classes.

Fall, Spring

GEO 430D Honors Project (4 Credits)

Fall, Spring, Annually

GEO 432D Honors Project (6 Credits)

Fall, Spring, Annually