ENV—EARTH AND ENVIRONMENTAL SCIENCES

COLLEGE OF ARTS AND SCIENCES

ENV U100 Earth and Environmental Sciences at Northeastern 1 SH
Intended for first-year students in the College of Arts and Sciences. Introduces students to liberal arts; familiarizes them with their major; develops the academic skills necessary to succeed (analytical ability and critical thinking); provides grounding in the culture and values of the University community; and helps to develop interpersonal skills—in short, familiarizes students with all skills needed to become a successful university student.

ENV U102 Marine Resources 4 SH
Provides a qualitative and quantitative survey of renewable and nonrenewable resources from the sea. Topics include coral reefs, shellfish, marine mammals, sharks, sport and recreational fishing, clams, lobsters, shrimp, toxic seafood, energy from the ocean, ocean pollution, shore erosion, beaches, coastal zone recreation, marine law, and law of the sea.

ENV U104 Physical Oceanography 4 SH
Provides a description of the physical properties and composition of seawater, waves, tides, and ocean currents. Discusses how these properties are measured by oceanographers and how they influence the earth’s environment and climate.

ENV U106 Biological Oceanography 4 SH
Covers the productivity of plant and animal life in the various zones of the ocean and the growing economic importance of the oceans as a source of food for the expanding world population.

ENV U108 New England Fisheries Resources 4 SH
Provides an overview of the fisheries industry of New England. Emphasizes environmental factors controlling the distribution, quality, and abundance of fisheries resources. Discusses the methods and the effects of direct human utilization of the resource as well as the effects of pollution and habitat modification.

ENV U110 Geology of Oceans and Coasts 4 SH
Examines the relationship between the form of the ocean basins and their margins, and the major processes forming them. Emphasizes local landforms including New England beaches, spits, barrier islands, and the continental shelf.

ENV U112 Environmental Geology 4 SH
Covers the causes and effects of problems resulting from human interaction with the earth and geologic processes. Topics include volcanoes, earthquakes, river flooding, soil erosion, groundwater pollution, landslides, and coastal erosion. Emphasizes land-use planning techniques to minimize environmental problems.

ENV U114 Natural Disasters and Catastrophes 4 SH
Provides an overview of what we know about the causes, locations, and effects of some of the most important natural disasters such as earthquakes, floods, and hurricanes. Also examines how loss of life and property damage can be minimized by implementing geologic knowledge. Briefly examines less common but possibly more devastating catastrophes such as large volcanic eruptions, large meteorite impacts, and rapid climate change.

ENV U115 Environmental Science 4 SH
Focuses on the complex mix of interlocking problems that are reaching crisis levels on Earth. Topics include population, resources, environmental degradation, and pollution. Focuses on food and land resources; air, soil, and water resources and pollution; and energy alternatives. Some emphasis is placed on culture, politics, worldviews, ethics, and economics.

ENV U116 Global Climate Change 4 SH
Covers the geologic history of the last ice age. Discusses the causes of extreme climate changes during the last 50 million years. Examines the landforms and sediments created by past ice sheets in North America and Europe.

ENV U118 Planetary Astronomy 4 SH
Focuses on astronomy of the solar system. Topics include description of the planets and other objects with discussion of how our understanding has evolved from the days of naked-eye observation to the present day of interplanetary probes.

ENV U120 Weather and Climate 4 SH
Discusses the patterns and processes that combine to produce our daily weather and how weather integrates over time to define climate. Identifies natural and human-made causes of climate change.

ENV U122 Age of Dinosaurs 4 SH
Utilizes evidence from the sedimentary rock record of the Mesozoic Era to interpret significant biological and physical events in earth history. Changes in the earth’s landscape due to variations in climate, mountain building, and sea level provide the background for detailed consideration of the history of Mesozoic life. A particular focus of this biological history is the evolution, classification, paleoecology, and extinction of the dinosaurs.

ENV U200 Dynamic Earth 4 SH
Offers a systematic study of the materials and systems comprising the earth. Emphasizes the processes that form, transport, alter, and destroy rocks, as well as the nature and development of landscape. Plate tectonics theory is introduced as a guiding paradigm in geology.
ENV U201 Lab for ENV U200 1 SH
Accompanies ENV U200. Covers exercises pertaining to mineral and rock identification and topographic and geologic map interpretation. Required for environmental geology and geology majors. Prereq. ENV U200 can be taken as a prerequisite or a corequisite for this course.

ENV U205 Physical Geography 4 SH
Introduces physical geography for students in history, political science, economics, or other social sciences who intend to pursue a career in education or other social sciences. Prereq. Permission of instructor.

ENV U220 History of Earth and Life 4 SH
Traces biological and physical development of the earth over the past 4.6 billion years using evidence preserved in rocks. A primary goal is to understand how geologists interpret events that occurred far in the geologic past. Topics include the origin of the earth and life, the evolution of life, and the causes and effects of major extinction events, the causes and results of mountain building and plate tectonics, and climate change over earth history.

ENV U221 Interpreting Earth History 1 SH
Focuses on students using sedimentary rocks, fossils, and geologic maps and stratigraphic sections to record and to interpret events in earth history.

ENV U230 Oceanography 3 SH
Introduces students to the scientific study of the ocean. Teaches basic understanding of global ocean processes and a more in-depth understanding of the waters through which students sail during their subsequent Sea Component. Covers the four interrelated disciplines of oceanography—physics, chemistry, biology, and geology. The development of proposals for independent student research projects to be carried out at sea is a key component of this shore-based course. Opportunities are provided to discuss current research with scientists working at the cutting edge of marine science. Includes lectures, labs, and field trips. Labs may include study of a coastal pond or salt marsh as an introduction to data collection, processing, chemical analyses, and microscopy that are used onboard ship. Part of the SEA Semester Program. Prereq. Acceptance into the SEA Semester Program; one laboratory science course.

ENV U231 Nautical Science 3 SH
Provides the theoretical background necessary for operating vessels at sea through lectures, lab sessions, field trips, and student projects. Covers the principles of navigating a vessel within sight of land; discussions include the earth’s coordinate system of latitude and longitude, nautical charts, and the magnetic compass. Students are also introduced to electronic navigation, including radar and GPS (Global Positioning System), and celestial navigation to fix the navigator’s position at sea. Topics include Archimedes’ principle, Newton’s laws, the Bernoulli effect, Boyle’s law, and mechanical advantage as applied to the study of vessels and their operation; vessel handling under sail; center of effort; operations under power; and vessel design. Classroom lectures, discussions, and student projects focus on learning about global, regional, and local weather. Part of the SEA Semester Program. Prereq. Acceptance into the SEA Semester Program.

ENV U232 Maritime Studies 3 SH
Focuses on a multidisciplinary study of the sea and sea voyage in the Western tradition and the role of the sea in the historical development of the modern world system of labor, trade, and scientific resource management. Tales of the sea from literature are supplemented with classic films, paintings, and songs. Together, students explore the expectations that they, as products of American popular and high culture, bring to their impending sea voyage. Through further readings, lectures, and field studies, students explore the uses we have made of the sea—from fishing and whaling to scientific exploration and warfare—with an eye toward understanding the roots of contemporary maritime affairs. Part of the SEA Semester Program. Prereq. Acceptance into the SEA Semester Program.

ENV U233 Practical Oceanography 1 4 SH
Exposes students to the skills and knowledge of the practicing oceanographer by observation and application of the concepts and sampling techniques introduced onshore. Tasks include carrying out routine lab procedures; extracting physical data for students’ research projects and for SEA’s ongoing oceanographic studies; processing chemical and biological samples; safely programming, deploying, and recovering oceanographic equipment; and maneuvering and positioning the vessel for each research station. Each day students participate in lectures, discussions, or hands-on study of specific topics in oceanography and nautical science. Part of the SEA Semester Program. Prereq. Acceptance into the SEA Semester Program.
ENV U234 Practical Oceanography 2 4 SH
Continues ENV U233. Focuses on the completion of student research projects and increasing responsibility for routine lab work, the sampling program, and operation of the vessel. The goal is for students to oversee the lab watch, direct their peers, plan and carry out station work with minimal staff supervision, finish analyzing and interpreting their data, complete written research papers, and present their research in a formal seminar format. May culminate with one or more ship's missions, which usually involves study of a particular area, either for SEA's data collections or at the request of another scientific agency, and allows students to integrate their nautical and science knowledge and to direct the vessel and its operation. Part of the SEA Semester Program. *Prereq. ENV U233 and acceptance into the SEA Semester Program.*

ENV U235 Practical Oceanographic Research 3 SH
Guides students at sea from an introductory learning phase to increasing responsibility in station planning, equipment deployment, and data interpretation. Each day, students participate in lectures, discussions, or hands-on study of specific topics in oceanography, nautical science, or maritime studies. Students also receive individual and small-group instruction by the scientific and nautical staff during regular watches in the lab and on deck. Focuses on analyzing and interpreting data, completing a written research paper, and presenting the research to the ship's company in a formal seminar format. The end of the cruise may also culminate in one or more missions, allowing students to integrate their nautical and science knowledge and to direct the vessel and its operation. Part of the SEA Semester Program. *Prereq. ENV U233 and acceptance into the SEA Semester Program.*

ENV U300 Advanced General Geology 4 SH
Offers an introduction to new and advanced concepts, theories, and hypotheses in general geology through discussions, research papers, and individual projects. *Prereq. Permission of instructor; ENV U200 can be taken as a prerequisite or a corequisite for this course.*

ENV U305 Special Topics in Environmental Studies 4 SH
Studies various topics on environmental issues.

ENV U310 Earth Materials 4 SH
Describes the physical and chemical characteristics of common rock-forming minerals to enable students to interpret properties of rocks and soils. Focuses on commonly encountered minerals, soil, and rock types and how minerals are used as indicators of past and present earth processes. *Coreq. ENV U311. Prereq. ENV U200, ENV U112, or ENV U115 and one semester of chemistry recommended.*

ENV U311 Lab for ENV U310 1 SH
Accompanies ENV U310. Cover topics from the course through various experiments. *Coreq. ENV U310.*

ENV U320 Igneous Petrology and Volcanology 4 SH
Examines the origin and nature of igneous rocks in general and volcanoes in particular. Surveys the characteristics and classification of igneous rocks, with a special emphasis on studying volcanic eruptive products and the nature of volcanic eruptions. Also covers the environmental impact and monitoring of volcanic activity. *Coreq. ENV U321. Prereq. ENV U200, ENV U201, and ENV U310.*

ENV U321 Lab for ENV U320 1 SH
Accompanies ENV U320. Exercises emphasize the identification and classification of igneous rocks as seen in hand specimen and with the aid of a petrographic microscope. *Coreq. ENV U320.*

ENV U324 Optical Crystallography 4 SH
Investigates the interaction of light and crystal structures utilizing the polarizing microscope. Emphasizes the microscopic identification of minerals on the basis of their optical properties. *Coreq. ENV U325. Prereq. ENV U201 and ENV U310.*

ENV U325 Lab for ENV U324 1 SH
Accompanies ENV U324. Exercises emphasize lab exercises that utilize the polarizing microscope to examine minerals in thin sections. *Coreq. ENV U324.*

ENV U326 Petrography 4 SH
Covers the description and identification of rocks, minerals, and textures viewed in thin section with a polarizing microscope. Interpretations of textures and mineral assemblages are emphasized. *Coreq. ENV U327. Prereq. ENV U325.*

ENV U327 Lab for ENV U326 1 SH
Accompanies ENV U326. Covers topics from the course through various experiments. *Coreq. ENV U326.*

ENV U336 Oceans in the Global Carbon Cycle 4 SH
Examines the role of the oceans in the climate system, addressing topics such as the global carbon cycle, the thermohaline circulation, and aspects of global change including warming and sea level rise. As a sink and a buffer for carbon dioxide in the atmosphere, and as a major mechanism of heat transport between the equator and high latitudes, the role of the oceans in setting the Earth’s climate is indisputable. *Prereq. Acceptance into the SEA Semester Program and three lab science courses.*
ENV U337 Ocean Science and Public Policy 4 SH
Provides students with a fundamental understanding of the intersection between climate change and government policy. After an introduction to the development of maritime law and sovereignty on the high seas, students examine why societies funded oceanic research, far from home territory, in the first place. The course also explores the interrelationship between science and government policy through selected case studies including the UN Conference on the Law of the Sea, the Intergovernmental Panel on Climate Change, the Kyoto Protocol, and cases presented in the World Court relating to industrialized nations’ greenhouse gas emissions and sea level change in the Pacific. Prereq. Acceptance into the SEA Semester Program.

ENV U338 Maritime History and Culture: The Caribbean 4 SH
Explores political, cultural, and social changes in the Caribbean since before Europeans arrived at the end of the fifteenth century. Starting from the maritime landscape of winds, currents, islands, and harbors, we see how the physical nature of the region has influenced patterns of settlement and development from the time of the Arawaks and Caribs to the commodification of the Caribbean as a modern tourist destination. Other topics include the impact of European expansion on peoples throughout the Atlantic world, especially at the transportation of some 5 million enslaved Africans into the Caribbean region; at the technology that underpinned European expansion; and at the cultural expressions that documented the extraordinary demographic changes that transformed the islands. Prereq. Acceptance into the SEA Semester Program.

ENV U339 Marine Environmental History: The Caribbean 4 SH
Explores the interaction of ecological factors in ocean, coastal, and island environments; the impact of human actions on those environments; and the need for local, regional, and international responses and strategies to mitigate and manage that impact. The enormous environmental changes that have taken place in the Caribbean Islands over the last five centuries provide us with a regional example of global issues. Looks at issues of resource exploitation, pollution, development, and the introduction of non-native species and attempts to understand the process by which we come to an intelligent understanding of these issues. Prereq. Acceptance into the SEA Semester Program.

ENV U340 Earth Landforms and Processes 4 SH
Focuses on the origin and evolution of landscape features by processes operating at or near the earth’s surface. Exercises introduce interpretation of air photos, topographic maps, remotely sensed data, and digital elevation models. Coreq. ENV U341. Prereq. ENV U200.

ENV U341 Lab for ENV U340 1 SH
Accompanies ENV U340. Covers topics from the course through various experiments. Coreq. ENV U340.

ENV U343 Environment and Life in 2090—A Projection 4 SH
Reviews how climate, environment, population patterns, and resource distribution today are affected by the Earth’s radiation balance, water cycle, and atmospheric transport of heat and circulation. These in turn affect ecosystems, sustainability of resource use, particularly society’s consumption of food and resources. These themes are projected to explore a range of possible scenarios of what life might be like in 2090. Explores various scenarios that imply different implications for society. Encourages discussion among students with different points of view on concepts of the definition of “sustainable future.” This course is designed to broaden students' global perspective on environmental issues and explore impacts that decisions today may have on the future. Prereq. Sophomore standing or permission of instructor.

ENV U390 Experiential Education Seminar 4 SH
Draws upon the student’s approved experiential activity and integrates it with study in the academic major. Restricted to those students who are using it to fulfill their experiential education requirement. Prereq. Permission of instructor.

ENV U400 Field Geology 4 SH
Provides hands-on training in field mapping techniques for geologic applications. Emphasizes making field observations of rocks and geologic structures and depicting them on geologic maps, cross sections, and in field notes. Meets at various field locations in the area. Fulfills the college’s experiential education requirement for geology majors. Prereq. ENV U200 and ENV U201 or permission of instructor.

ENV U410 Environmental Geochemistry 4 SH
Provides a context for understanding environmental problems through studies in atmospheric, terrestrial, freshwater, and marine geochemistry. Topics include aqueous geochemistry, environmental chemical analysis, nature and source of hazardous wastes (environmental chemistry, reduction, treatment and disposal), acid rain, ozone hole, nuclear winter, green engineering, and alcohol production. Prereq. ENV U112, ENV U115, or ENV U200 and one semester of chemistry recommended.

ENV U412 Igneous and Metamorphic Petrology 4 SH
Covers the origin and distribution of igneous and metamorphic rocks as interpreted from mineralogy, texture, chemistry, and field relationships. Emphasizes microscopic and hand specimen examination of rock samples. Coreq. ENV U413. Prereq. ENV U326.

ENV U413 Lab for ENV U412 1 SH
ENV U418 Geophysics 4 SH
Studies the basic techniques of reflection and refraction seismology, gravity, and magnetic surveying, and the information they provide on the earth’s interior. Discusses earthquakes. Emphasis is on near-surface exploration. Prereq. ENV U200.

ENV U500 Geology Seminar 4 SH
Focuses on analysis of selected topics in geology for advanced study. Topics are selected from current areas of active research in the field. Prereq. Permission of instructor.

ENV U501 Geologic Field Seminar 4 SH
Consists of two parts: an intensive classroom study of aspects of geology associated with a particular field setting, followed by an intensive field investigation. Examples include carbonate petrology and reef ecology followed by field studies in the Bahamas; glacial geology and volcanology followed by field studies in Iceland; or stratigraphy of the U.S. Southwest followed by field studies in the Grand Canyon. Prereq. Permission of instructor.

ENV U510 Environmental Planning 4 SH
Examines aspects of surface runoff from geomorphic and hydrologic perspectives. Develops methods for description and calculation of major river and drainage basin processes, and applies these tools to the planning process. Examines human modification of these systems including urbanization, dams, and channelization, and applies this information to an understanding of regulatory processes. Prereq. ENV U200 or permission of instructor.

ENV U515 Sustainable Development 4 SH
Focuses on the development of communities in an environmentally sustainable way and on the division of natural resources within these communities and the global system. Defines and discusses "sustainable development" and its global role today. Exposes students to a history of developmental methods while learning about the interconnectedness of development and the environment. Encourages students to draw conclusions about the environmental impacts of these methods and to consider more equitable uses of natural resources. Prereq. Permission of instructor.

ENV U520 Applied Hydrogeology 4 SH
Covers the origin, distribution, and flow of groundwater in permeable sediments and bedrock; hydrogeological and geological characteristics of aquifers; regional flow systems emphasizing rock structure, stratigraphy, and other aspects of the geological environment; principles of hydrogeologic mapping and analysis; and introduction to well testing and well hydraulics. An individual research project augments class activities. Coreq. ENV U521. Prereq. ENV U200.

ENV U521 Lab for ENV U520 1 SH
Accompanies ENV U520. Covers topics from the course through various experiments. Coreq. ENV U520.

ENV U523 Soil Science 4 SH
Provides a description and evaluation of the physical, chemical, and biological properties of soils. Includes soil formation, soil types, and processes that occur in soil including the importance of these processes for the soil productivity and the management of soil. Also covers sources, reactions, transports, and fates of chemical species in soils and associated water and air environments, as well as the chemical behavior of elements and compounds and the phenomena affecting natural and anthropogenic materials in soils. Prereq. ENV U201 and CHM U101 or CHM U211.

ENV U530 Structural Geology 4 SH
Focuses on the nature and origin of rock structures produced during deformation of the Earth’s crust. Emphasizes analysis of the geometric relationships of structural features and interpreting the possible stress and tectonic environments that produced them. There is a field trip to study many of the structural features discussed in lectures. Coreq. ENV U531 required for geology majors but optional for all others. Prereq. ENV U200 and ENV U201.

ENV U531 Lab for ENV U530 1 SH
Accompanies ENV U530 and is required for all geology majors but optional for all others. Lab exercises and homework include utilizing geologic maps, cross sections, stereographic projections, rock specimens, the petrographic microscope, and field data to analyze structural features and interpret their origins. Coreq. ENV U530.

ENV U535 Introduction to Remote Sensing 4 SH
Explores the fundamental concepts of remote sensing of the environment. Topics include digital imagery from spacecraft, conventional and high-altitude aerial photography, orthophotography production, and surface modeling systems. Offers hands-on experience with basic functions of industry standard image processing software. Coreq. ENV U536. Prereq. ENV U200 or permission of instructor.

ENV U536 Lab for ENV U535 1 SH
Accompanies ENV U535. Covers topics from the course through various applied activities. Coreq. ENV U535.

ENV U540 Sedimentary Basin Analysis 4 SH
Presents the analysis of sedimentary basins based on detailed study of sedimentary petrology, sedimentary structures, and stratigraphic sequences and fossils. Coreq. ENV U541. Prereq. ENV U220 and ENV U221.
ENV U541 Lab for ENV U540  1 SH
Accompanies ENV U540. Lab work uses geologic sections, suites of sedimentary rocks and thin sections, and drill cores and borehole logs to interpret and analyze the geologic history and environmental and economic potential of sedimentary basins. Coreq. ENV U540.

ENV U542 Fossils and Paleoeocology  4 SH
Surveys major events, processes, and important invertebrate phyla preserved in the fossil record. This knowledge of paleontology is then utilized to evaluate evolutionary principles and the nature of function and adaptation in the history of life. Organization of populations into paleocommunities and their relationships to changes in environments through time permit the assessment and evaluation of paleoecology in earth history. Coreq. ENV U543. Prereq. ENV U220 and ENV U221 or permission of instructor.

ENV U543 Lab for ENV U542  1 SH
Accompanies ENV U542. Introduces invertebrate fossil morphology by study of fossil specimens of all major groups. Principles of paleoecology and evolutionary theory are illustrated by analysis of suites of fossil specimens. Coreq. ENV U542.

ENV U544 Sedimentation  4 SH
Describes the physical processes of sedimentation and their role in the interpretation of sedimentary environments. Coreq. ENV U545. Prereq. ENV U200 or permission of instructor.

ENV U545 Lab for ENV U544  1 SH

ENV U546 Coastal Processes  4 SH
Examines the effect of coastal marine processes and the resultant coastal responses. Topics include the dynamics of waves and currents and the associated erosion, transportation, and deposition of sediment-forming beaches, barrier islands, and cliffed shorelines. Coreq. ENV U547. Prereq. ENV U200 and permission of instructor.

ENV U547 Lab for ENV U546  1 SH
Accompanies ENV U546. Covers topics from the course through various experiments. Coreq. ENV U546.

ENV U548 Marine Geology  4 SH
Compares the balance between major sedimentary and tectonic forces in ocean basins and margins to the resulting ocean form. Topics include origin of continental margins, shelf sedimentation and transport, and deep-sea processes and sediments. Evaluates resource development of OCS oil, sand and gravel, and manganese nodules. Prereq. ENV U200 and permission of instructor.

ENV U549 Marine Geology and Land-Use Planning  4 SH
Examines the underlying geologic factors common to most environmental land-use problems and presents land-use planning strategies for their mitigation. Emphasizes environmental hazards such as landslides, stream flooding and erosion, coastal flooding and erosion, groundwater pollution, ground subsidence, and soil erosion. Prereq. ENV U200 and ENV U201.

ENV U550 Geology and Land-Use Planning  4 SH
Examines the underlying geologic factors common to most environmental land-use problems and presents land-use planning strategies for their mitigation. Emphasizes environmental hazards such as landslides, stream flooding and erosion, coastal flooding and erosion, groundwater pollution, ground subsidence, and soil erosion. Prereq. ENV U200 and ENV U201.

ENV U551 Wetlands  4 SH
Presents an interdisciplinary overview of physical, biological, and cultural aspects of wetlands for students majoring in geological, biological, or social sciences with an interest in wetland environments and resources. Topics covered include: definitions, classification systems, origins, and natural processes of wetland environments. Includes wetlands in boreal and tropical climates though the focus is on temperate geographic settings. Looks at hydrology, soils, and vegetation and their relationship to ecosystem processes, societal values, and management. Examines human use, modification, exploitation, jurisdictional delineation, and management options, along with legal and political aspects of wetlands. Requires fieldwork in both freshwater and marine wetlands. Prereq. ENV U115, ENV U200, or permission of instructor.

ENV U552 Geographic Information Systems  4 SH
Introduces students to the use of a geographic information system (GIS), and explores the practical application of GIS to support geographic inquiry, analysis, and decision making. Topics include spatial data collection; data accuracy and uncertainty; cartographic principles and data visualization; geographic analysis; and legal, economic, and ethical issues associated with the use of a GIS. Students gain hands-on experience with a leading commercial GIS software package. Case studies from geology, environmental science, urban planning, architecture, social studies, and engineering are investigated. Coreq. ENV U561. Prereq. Permission of instructor.

ENV U553 Lab for ENV U552  1 SH
Accompanies ENV U560. Covers topics from the course through various experiments. Coreq. ENV U560.
ENV U562 GIS Workshop 2 SH
Studies the basic techniques of reflection and refraction seismology, gravity, aeromagnetic, and heat-flow processes and the information they provide on the structure, composition, and dynamics of the earth’s interior. Prereq. Permission of instructor.

ENV U563 Advanced Spatial Analysis 4 SH
Provides an in-depth evaluation of theoretical, mathematical, and computational foundations of geographic information systems (GIS). Topics include spatial information theory, database theory, mathematical models of spatial objects, and GIS-based representation. Examines advanced concepts and techniques in raster-based GIS and high-level GIS modeling techniques. Prereq. ENV U560.

ENV U570 Glacial and Quaternary History 4 SH
Covers the processes of ice movement and the characteristics and distribution of erosional and depositional structures associated with past and present glaciers; introduces Quaternary chronology. An individual research project augments class activities. Coreq. ENV U571. Prereq. ENV U200.

ENV U571 Lab for ENV U570 1 SH
Accompanies ENV U570. Covers topics from the course through various experiments. Coreq. ENV U570.

ENV U580 Groundwater Modeling 4 SH
Uses computers to solve problems in the flow of groundwater. Develops concepts of groundwater flow. Uses the finite difference method to model steady-state and transient flow. Programs are supplied by the instructor so programming skill is not a prerequisite. Prereq. MTH U141 or equivalent.

ENV U582 Groundwater Geochemistry 4 SH
Investigates important geological processes that occur when groundwater interacts with rock or soil, modifying groundwater chemistry and affecting water quality. Examines groundwater contamination and dispersion, isotope tracer studies, field sampling, and analytical methods. Prereq. CHM U211.

ENV U585 Engineering Geology 4 SH
Studies the application of geology to the site selection, design, and environmental impact of engineering structures such as foundations, dams, tunnels, highways, landfills, excavations, and nuclear waste disposal sites. Prereq. ENV U200.

ENV U700 Senior Thesis 4 SH
Offers students an opportunity to prepare an undergraduate thesis under faculty supervision. Same as INT U700. Prereq. Senior standing and permission of instructor.

ENV U900 Earth and Environmental Science Capstone 1 SH
Designed for students enrolled in concert with an approved 500–600-level environmental studies course (check with department office for up-to-date listings). Faculty help students to identify topics for individual research tailored to students’ interests and the course content. Provides an opportunity for reflection about what the student has learned in the major, in their NU Core course work, and experiential learning. Required components include writing with revision and an oral presentation at a departmentwide capstone seminar late in the semester. Prereq. Completion of the out-of-class component of the experiential education requirement; junior or senior standing.

ENV U921 Directed Study 1 SH
ENV U922 Directed Study 2 SH
ENV U923 Directed Study 3 SH
ENV U924 Directed Study 4 SH
Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. Prereq. Permission of instructor.

ENV U964 Research 4 SH
Offers independent research on a selected topic under the direct supervision of a faculty member. Fulfills the college’s experiential education requirement for geology majors. Prereq. Permission of instructor and junior or senior standing.

ENV U970 Junior/Senior Honors Project 1 4 SH
Focuses on in-depth project in which a student conducts research or produces a product related to the student’s major field. Culminating experience in the University Honors Program. Combined with Junior/Senior Project 2 or college-defined equivalent for 8-credit honors project. Prereq. Honors program participation.

ENV U971 Junior/Senior Honors Project 2 4 SH
Focuses on second semester of in-depth project in which a student conducts research or produces a product related to the student’s major field. Culminating experience in the University Honors Program. Prereq. ENV U970 and honors program participation.