

# EARTH AND ENVIRONMENTAL SCIENCES (EESC)

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## **EESC 111 - Planet Earth (4 Credit Hours)**

An introduction to the study of the Earth and its environment. This includes how it formed, how it evolved, how Earth systems interact to produce the environment in which we live, how Earth scientists interpret the materials of the planet and how humans use Earth resources. Laboratory exercises include learning to identify and interpret minerals and rocks, using maps and imagery to understand landscape processes, quantifying water resources to understand future use and examining natural hazards and mitigation. This course is designed as an introductory course in Earth & Environmental Sciences for both science and non-science majors. Fulfills the Q (Quantitative Reasoning) GE requirement.

## **EESC 112 - Special Topics in Earth & Environmental Science (4 Credit Hours)**

What does it take to build a planet that harbors intelligent life? Are habitable planets common in the Universe, or is Earth the only one? In this course we will examine the development of planet Earth in light of the hypothesis that conditions necessary for a habitable planet are extremely rare in the universe. While emphasizing geology, this examination will involve us in aspects of biology and paleontology, astronomy and astrogeology, philosophy and even theology. Laboratory exercises will allow hands-on investigation of rocks, fossils, geologic maps, and other data important to our understanding of the development of planet Earth. This course is designed as an introductory course in the Earth & Environmental Sciences for both science and non-science major. Fulfills the R (Oral Communication) GE requirement.

## **EESC 114 - Special Topics in Earth & Environmental Science (4 Credit Hours)**

Cool Science on a Hot Topic. Global warming constitutes one of the most controversial issues you, and society at large, will face in the future. At the center of this debate lies the question, "Are we responsible for the recent increase in global temperature, or is this trend part of the natural variability in the climate system?" To evaluate these possibilities, we will examine the geologic record of climate change and the processes responsible for these variations. While the majority of our discussions will focus on geology, we will also touch on elements of oceanography, meteorology, biology, paleontology, as well as policy and politics. By the end of this course you will be able to make informed decisions about the climate change issues we are certain to face in the future. This course is designed as an introductory course in the Earth & Environmental Sciences for both science and non-science majors and to fulfill the Q (Quantitative Reasoning) GE requirement.

## **EESC 115 - Special Topics in Earth & Environmental Science (4 Credit Hours)**

This course provides a venue to explore different topics in Earth & Environmental Sciences at the introductory level.

## **EESC 199 - Introductory Topics in Earth & Environmental Science (1-4 Credit Hours)**

A general category used only in the evaluation of transfer credit.

## **EESC 200 - Environmental Geology (4 Credit Hours)**

A broad survey of the geologic aspects of environmental issues, emphasizing human interactions with the geologic environment. Topics include geologic hazards, such as earthquakes, landslides and flooding; global water supply and water quality issues, especially groundwater contamination and remediation; and global environmental change, with emphasis on climate change and global warming. This course fulfills the W overlay requirement.

**Prerequisite(s):** A 100-level course or ENVS 102 or consent of instructor.

## **EESC 210 - Historical Geology (4 Credit Hours)**

A survey of the geologic history of planet Earth. Major topics include global climate history, paleogeography, history of life, and tectonic development and evolution of the North America continent. Lab exercises focus on description and interpretation of sedimentary rocks and environments, and the history of biological evolution.

**Prerequisite(s):** A 100-level course or ENVS 102 or consent of instructor.

## **EESC 211 - Rocks, Minerals & Soils (4 Credit Hours)**

An introduction to the minerals, rocks and soils that make up the Earth and how those materials influence and are influenced by the processes that operate within and on the surface of the planet. This course is part of the foundation in the Earth & Environmental Sciences for understanding our planet. The course provides a geological, chemical and physical basis for understanding the composition and physical properties of minerals, rocks and soils, and emphasizes the interplay between Earth materials, Earth systems, society and the environment.

**Prerequisite(s):** A 100-level course or ENVS 102 or consent of instructor.

## **EESC 215 - Special Topics in Earth & Environmental Sciences (4 Credit Hours)**

This course provides a venue to explore different topics in Earth & Environmental Sciences at the intermediate level".

## **EESC 222 - Geographic Information Systems I (2 Credit Hours)**

This course is an introduction to the concepts and uses of Geographic Information Systems (GIS) with particular application to environmental issues. The course consists of laboratory exercises on GIS data structures and sources of data, on the use of specific GIS tools, and on practical applications of GIS to real-world tasks. The student will gain skills in spatial data analysis, map generation, and data presentation using ArcGIS software. After successful completion of this course, students who wish to develop advanced GIS skills may enroll in ENVS/EESC 223.

**Crosslisting:** ENVS 222.

## **EESC 223 - Geographic Information Systems II (2 Credit Hours)**

This course is intended to give the student experience with advanced GIS applications. The focus will be on novel analyses of spatially explicit data pertaining to real-world environment issues.

**Prerequisite(s):** EESC 222 or ENVS 222.

**Crosslisting:** ENVS 223.

**EESC 234 - Applied GIS for Earth and Environmental Sciences (4 Credit Hours)**

Geographic Information Systems (GIS) allow the organization, analysis, and display of large and varied collections of spatial information. Earth and environmental scientists are increasingly relying on the tools and methodologies of GIS to solve complex problems ranging from the intersection of rising sea level with coastal communities to the mapping and mitigation of landslide hazards in mountain communities. In this course, we will conduct a series of applied projects investigating Earth systems and environmental problems. Each project will include hands-on downloading of data, data processing, developing workflows in ArcGIS, mapmaking and data visualization, and communicating results in written reports. By the end of the term, students will apply the skills learned over the semester in an independent research project.

**EESC 240 - Earth Resources (4 Credit Hours)**

This course examines the Earth resources that humans exploit, including (but not limited to) energy, metals, and soil, from both geologic and societal perspectives. We will study: (1) the geologic processes that form these deposits and control their distribution; (2) the methods used to extract the resources and; (3) environmental impact of extraction and resource use. We will also scrutinize the effect on society of the resource, including conflict, labor, sustainability and class issues. The course will combine lab activities, scientific discussion and readings from academic literature, popular media, and activist propaganda. The end result will be the ability to bring together the science of Earth resources with the broader human context of resource exploitation. This course fulfills the P (Power & Justice) GE requirement.

**Prerequisite(s):** A 100 level or ENVS 102 or consent of instructor.

**EESC 270 - Oceanography (4 Credit Hours)**

This course will provide students with an introduction to the world's oceans. Topics will include: the sea floor and its sediments; the physical properties and chemistry of seawater; ocean circulation; waves and tides; life in the seas; and environmental issues and concerns facing the oceans today. By the end of this course students will have explored many of the basic concepts in modern oceanography, and should be able to integrate new concepts and data into their developing knowledge of the Earth.

**EESC 275 - Geology of the Solar System (4 Credit Hours)**

In this course, you will discover the wide variety of geologic processes at work across the planets, moons, asteroids and comets of our solar system. We will examine the missions and instruments used to observe extraterrestrial objects, the data collected and how to use it to unravel the geologic history of distant areas and what conditions are needed to support life outside Earth. In the end, you will design your own mission to investigate another piece of the solar system. This course will be a mix of class lecture and activities, labs and presentations/discussions with readings from academic publications, popular media and books. Fulfills the R (Oral Communication) GE requirement.

**Prerequisite(s):** A 100-level course or ENVS 102 or consent of instructor.

**EESC 299 - Intermediate Topics in Earth & Environmental Sciences (1-4 Credit Hours)**

A general category used only in the evaluation of transfer credit.

**EESC 300 - Geomorphology (4 Credit Hours)**

We will investigate how Earth's topography reflects the response of surface processes to shifts in tectonic, climatic, and human influences. Our study of landscape evolution will focus primarily on hillslopes (creeping soil to catastrophic landslides), rivers (gullies to bedrock gorges), and glaciers (alpine cirques to Midwest moraines) always with a focus on quantifying how the shapes of landforms reflect process. Labs and class activities will require a blend of fieldwork, introductory mapping and data analysis using ArcGIS, and simple numerical modeling. Frequent, short critical writing responses to primary literature will refine both writing skills and our engagement with the forefront of process geomorphology. This course fulfills the W overlay requirement.

**Prerequisite(s):** EESC 200 or EESC 210 or EESC 211 or consent of instructor.

**EESC 308 - Biodiversity Through Time (4 Credit Hours)**

An introduction to the study of fossil invertebrates with emphasis on preservation, taphonomy, diversity trajectories through geologic time, evolutionary mechanisms, extinction, paleobiology and paleoecology. Special emphasis will be placed on using fossils to interpret ancient depositional environments. Labs will introduce the student to the major invertebrate phyla commonly preserved in the geologic rock record.

**Prerequisite(s):** EESC 210 or BIOL 230.

**EESC 310 - Global Biogeochemical Cycles (4 Credit Hours)**

Global Biogeochemical Cycles explores the physical, chemical, biological, and geological processes that govern the composition of, and changes to, Earth's surface environment. This course will focus on the global cycles of carbon, nitrogen, phosphorus, and sulfur and their interactions with organisms and earth materials as they move through the atmosphere, hydrosphere, biosphere, and lithosphere. This multidisciplinary course is intended for students curious about life's influence on the planetary system. It will cover aspects of biology, geology, hydrology, meteorology, oceanography, and soil science. That said, no specific disciplinary background is required other than a fundamental understanding of elemental chemistry.

**Prerequisite(s):** EESC 200 or EESC 210 or EESC 211 or consent of instructor.

**EESC 311 - Structural Geology (4 Credit Hours)**

Study of the deformation of the Earth's crust. How and why rocks deform; geometry and interpretation of folds, faults, and rock fabrics; regional tectonics and mountain building. Labs emphasize interpretations of geologic structures in hand specimens, outcrops and geologic maps; and includes opportunities for geologic field mapping and a weekend field trip to the Appalachian fold and thrust belt.

**Prerequisite(s):** EESC 210 or EESC 211 or consent of instructor.

**EESC 312 - Petrology and Volcanology (4 Credit Hours)**

This course examines the processes that produce magma and metamorphic at high temperature. It also explores volcanism and the hazards produced by eruptions. We will employ the reasoning and approaches used to understand petrology including petrography, geochemistry, data analysis and modeling. Key topics include high-temperature isotopes and thermodynamics, formation of magmas in different tectonic settings, the physical processes of volcanism, hazards posed by volcanic activity and using metamorphic reactions to assess the tectonic history of rocks. We will explore petrology and volcanology through labs, primary literature, research projects and group assignments.

**Prerequisite(s):** EESC 211 or consent of instructor.

**EESC 313 - Environmental Hydrology (4 Credit Hours)**

This course explores the processes that transfer water between the various reservoirs of the hydrologic cycle. Working mostly at the watershed scale, we will study the balance between precipitation, evapotranspiration, and runoff by drawing on both field methods and the analysis of hydrologic datasets using Geographic Information Systems (GIS). We will study the flow of surface water through natural and engineered rivers, and the flow of groundwater through shallow soils and deep aquifers. Throughout the course, we will strive for an applied approach to Hydrology that explicitly links key concepts to the management of water resources.

**Prerequisite(s):** EESC 200 or EESC 210 or EESC 211 or consent of instructor.

**EESC 314 - Sedimentology & Stratigraphy (4 Credit Hours)**

This course is an introduction to sedimentary processes and sedimentary rocks. The course will cover three major areas: (1) physical sedimentology (how sedimentary rocks are formed); (2) depositional systems (where sedimentary rocks are formed and how they differ from place to place); and (3) stratigraphy (how sedimentary rocks are used to solve geological problems). Labs will expose students to sedimentary rocks under the microscope, in hand sample, and in the field.

**Prerequisite(s):** EESC 200 or EESC 210 or EESC 211 or consent of instructor.

**EESC 333 - Stable Isotopes in the Environment (4 Credit Hours)**

Light stable isotope analysis has become a nearly ubiquitous component of (paleo)environmental research. Stable isotopes of Hydrogen, Carbon, Nitrogen, Oxygen, and Sulfur have been used to integrate, indicate, record, and trace important physical and biological processes operating at or near Earth's surface. This course will focus on how stable isotope systems can be used to study (paleo)climatology and (paleo)oceanography, hydrology, pollution, biogeochemical cycling, metabolism, photosynthesis, and (paleo)ecology.

**Prerequisite(s):** EESC 200 or EESC 210 or EESC 211 or consent of instructor.

**EESC 361 - Directed Study (1-4 Credit Hours)**

Individual readings and laboratory work in a student's field of interest within the Earth & Environmental Sciences.

**EESC 362 - Directed Study (1-4 Credit Hours)**

Individual readings and laboratory work in a student's field of interest within the Earth & Environmental Sciences..

**EESC 363 - Independent Study (1-4 Credit Hours)****EESC 364 - Independent Study (1-4 Credit Hours)****EESC 370 - Global Tectonics (4 Credit Hours)**

A study of geologic and tectonic processes at the global scale. Major topics include plate tectonic theory and development, topography and geology of the sea floor, plate geometries and processes at plate margins, volcanic arcs, collisional orogenies and mountain building, and the influence of tectonic processes on earth history.

**Prerequisite(s):** EESC 210 or EESC 211 or consent of instructor.

**EESC 380 - Earth & Environmental Sciences Senior Seminar (1 Credit Hour)**

This course is designed to help majors apply what they have learned throughout their undergraduate careers to a real-world issue or topic in the geosciences. The seminar will meet weekly with all members of the Geoscience faculty. The seminar topic will be selected by the entire geosciences faculty. Both students and faculty will be responsible for presenting summaries of weekly readings, although the majority will be presented by students. The course will be organized and administered by the department chair. Sophomore, Junior or Senior Earth & Environmental Science majors.

**EESC 399 - Advanced Topics in Earth & Environmental Sciences (1-4 Credit Hours)**

A general category used only in the evaluation of transfer credit.

**EESC 400 - Field Course (4-8 Credit Hours)**

A B.S. major in Geosciences must register for an approved summer field course offered by any one of a number of universities. Upon the successful completion of the course, the student receives credit transferable to their record at Denison.

**EESC 451 - Senior Research (4 Credit Hours)****EESC 452 - Senior Research (4 Credit Hours)**