

# Earth & Environmental Science (EES)

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## **EES 0827. Hidden Figures to Gamergate: Race and Gender in Science and Technology. 3 Credit Hours.**

Who do you think of when someone asks you to draw a scientist? In this GenEd course we explore the myriad of ways in which racial and gender stereotypes have affected our perception of what it means to be an accomplished scientist. When we think of influential scientists, the names Claudia Alexander and Carolyn Parker should come as easily to the mind as Buzz Aldrin or Thomas Edison. We will discuss how the public perceives science and scientists, and explore the implications of this in terms of how science serves a diverse society. We will also explore the ways in which violence and misogyny have impacted our digital world. Technology and science change our society; who authors this change influences how we participate in the process and the cultural narrative of who innovates and leads our society, which is critical to the current controversy of science in politics.

**Course Attributes:** GD

**Repeatability:** This course may not be repeated for additional credits.

## **EES 0836. Disasters: Geology vs. Hollywood. 3 Credit Hours.**

This course is typically offered in Fall, Spring, and Summer.

Clips from Hollywood disaster movies will drive our inquiry into geologic phenomena. Can you really drive over a lava flow in a jeep? (Dante's Peak) Are we foolish not to prepare for a major earthquake in New York City? (Aftershock) Could global warming melt the polar ice caps turning "dry land" into a myth? (Waterworld) Would the impact of an asteroid the "size of Texas" kill half the Earth by heat and freeze the remainder in a nuclear winter? (Armageddon) Learn the fundamentals of plate tectonics, how petrologic properties control volcanic explosivity, how to calculate earthquake locations from seismic data, and prepare a disaster readiness plan for a major U.S. city. NOTE: This course fulfills a Science & Technology (GS) requirement for students under GenEd and Science & Technology Second Level (SB) for students under Core.

**Course Attributes:** GS, SF

**Repeatability:** This course may not be repeated for additional credits.

## **EES 0837. Evolution of Earth and Its Life. 3 Credit Hours.**

This course is typically offered in Fall and Spring.

The Earth is our home, but few of us stop to consider in detail how it works and changes. Although popularly applied mostly to biological systems, the word evolution simply means "change through time". This course intends to foster understanding of the Earth as an evolving and changing interconnected system across the vast expanse of 4.5 billion years of geologic history. Where did we come from? How did we get where we are now? What can we expect in the future? Through hands-on experience with fossils and rocks, students discover how to decode information about past Earth environments and ecosystems and the implications of this knowledge for understanding current and future global issues. Special focus is given to major interactions between the living and non-living parts of the Earth system, including major mass extinction events, many of which have been linked to climate shifts with disastrous consequences for living organisms. (Prior to Spring 2022, this course was titled "Evolution & Extinctions". Students may not receive credit for both EES 0837: Evolution & Extinctions and EES 0837: Evolution of Earth and Its Life.) NOTE: This course fulfills a Science & Technology (GS) requirement for students under GenEd and Science & Technology Second Level (SB) for students under Core.

**Course Attributes:** GS, SE, SF, SS

**Repeatability:** This course may not be repeated for additional credits.

## **EES 0842. Sustainable Environments. 3 Credit Hours.**

This course is typically offered in Fall, Spring, and Summer.

Humans are at a critical juncture in their relationship with the environment. Many of the global changes occurring in the atmosphere, climate, and oceans can be attributed to human activity. While the standard of living has increased for many people across the globe, the technological advancements that have made this possible endanger future generations because of their environmental impacts. Environmental toxins and air pollution are increasing, and fossil fuels and forests are being depleted at unsustainable rates. Now more than ever, the viability of human life depends on the scientific understanding of global environmental change, and on developing science-based policies to both protect the environment and promote human well-being in a just and sustainable manner. Course mission: enhance your capability to be environmentally informed consumers and citizens based on a sound understanding of the ecological, technological, economic, political, and ethical dimensions of environmental sustainability. NOTE: This course fulfills a Science & Technology (GS) requirement for students under GenEd and Science & Technology Second Level (SB) for students under Core. Students cannot receive credit for this course if they have successfully completed GUS 0842/0942 or ENST 0842/0942.

**Course Attributes:** GS, SE, SF, SP, SS

**Repeatability:** This course may not be repeated for additional credits.

**EES 0854. Geology of the National Parks. 3 Credit Hours.**

This course is typically offered in Fall.

The primary purpose of the National Park Service is to preserve areas of natural or cultural interest for current and future generations. Quite commonly these areas of interest, such as the Grand Canyon, or Yellowstone National Park, are the result of extreme geologic forces which have shaped the landscape. The goal of this class is to use geologic principles to understand the "science of the scenery" of individual parks. Students will also address key issues within individual parks, such as the competing interests of visitor access vs. land management, the societal need for natural resources, and the preservation of unique or delicate ecosystems. NOTE: (1) This course fulfills a Science & Technology (GS) requirement for students under GenEd and Science & Technology Second Level (SB) for students under Core. (2) Students cannot receive credit for this course if they have successfully completed EES 0954.

**Course Attributes:** GS, SE, SF, SP, SS

**Repeatability:** This course may not be repeated for additional credits.

**EES 0873. Evil Plots. 4 Credit Hours.**

Computer technology and the internet have produced a glut of digital information that can't be communicated without using charts and graphs. But like all forms of human communication, graphs can fib a little or lie outright. There are three basic ways data visualizations can go wrong: (1) The plot can be evil, designed to persuade or mislead rather than inform; (2) the data set may be suspect (too small, biased, or full of errors); or (3) even if the plot and data are okay, they may not support the claims being made. In this class, we will explore the representation and misrepresentation of data, learn the questions to ask about data quality, and how to spot falsehoods and fallacies in the digital age. Examples will be drawn from science, politics, marketing, business and more. Protect yourself by learning to spot evil plots! Students cannot receive credit for this course if they have successfully completed EES 0973.

**Course Attributes:** GQ

**Repeatability:** This course may not be repeated for additional credits.

**EES 0874. Environmental Life Cycle Analysis: Does Buying "Green" Matter?. 4 Credit Hours.**

With increasing societal awareness of environmental sustainability, many industry and business sectors have prioritized the development and application of green technology and/or green processes over the course of a product's life span. Life cycle analysis (LCA) is a scientific methodology that systematically examines both cumulative and potential environmental impacts of a product over its entire life cycle, ranging from the extraction of raw Earth materials to its disposal when all the materials ultimately return to the Earth. LCA can also provide comparative impacts among the different products, and both companies and consumers benefit from the environmental rating systems for their marketing and decision making processes. Through this course, we will learn how LCA model works in detail, using real-world examples, such as paper vs plastic bags, cathode ray tube (CRT) vs liquid crystal display (LCD) technology, as well as electronic wastes.

**Course Attributes:** GQ, SE, SF, SP, SS

**Repeatability:** This course may not be repeated for additional credits.

**EES 0954. Honors Geology of the National Parks. 3 Credit Hours.**

This course is typically offered in Fall.

The primary purpose of the National Park Service is to preserve areas of natural or cultural interest for current and future generations. Quite commonly these areas of interest, such as the Grand Canyon, or Yellowstone National Park, are the result of extreme geologic forces which have shaped the landscape. The goal of this class is to use geologic principles to understand the "science of the scenery" of individual parks. Students will also address key issues within individual parks, such as the competing interests of visitor access vs. land management, the societal need for natural resources, and the preservation of unique or delicate ecosystems. NOTE: (1) This course fulfills a Science & Technology (GS) requirement for students under GenEd and Science & Technology Second Level (SB) for students under Core. (2) Students cannot receive credit for this course if they have successfully completed EES 0854. (3) This is an Honors course.

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR.

**Course Attributes:** GS, HO, SE, SF, SP, SS

**Repeatability:** This course may not be repeated for additional credits.

**EES 0973. Honors Evil Plots. 4 Credit Hours.**

Computer technology and the internet have produced a glut of digital information that can't be communicated without using charts and graphs. But like all forms of human communication, graphs can fib a little or lie outright. There are three basic ways data visualizations can go wrong: (1) The plot can be evil, designed to persuade or mislead rather than inform; (2) the data set may be suspect (too small, biased, or full of errors); or (3) even if the plot and data are okay, they may not support the claims being made. In this class, we will explore the representation and misrepresentation of data, learn the questions to ask about data quality, and how to spot falsehoods and fallacies in the digital age. Examples will be drawn from science, politics, marketing, business and more. Protect yourself by learning to spot evil plots! Students cannot receive credit for this course if they have successfully completed EES 0873. This is an Honors course.

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR.

**Course Attributes:** GQ, HO

**Repeatability:** This course may not be repeated for additional credits.

**EES 1001. Introductory Geology. 4 Credit Hours.**

This course is typically offered in Fall, Summer I and Summer II.

An introduction to the basic principles and processes of geology. Wide range of topics, including rocks and minerals, surface processes, plate tectonics, and the earth's interior. NOTE: This course can be used to satisfy the university Core Science & Technology First Level (SA) requirement. To determine if this course in combination with another course can satisfy the GenEd Science & Technology requirement, see your advisor.

**Course Attributes:** SA

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in (any MATH course numbered 0701 to 0702, any MATH course numbered 0800 to 4999 (may be taken concurrently), 'Y' in MC3, 'Y' in MC4, 'Y' in MC5, 'Y' in MC6, STAT 1001 (may be taken concurrently), 'Y' in STT2, STAT 1102 (may be taken concurrently), STAT 1902 (may be taken concurrently), 'Y' in MC3A, 'Y' in MC6A, 'Y' in MATW, 'Y' in MC3S, 'Y' in MC3D, 'Y' in MC3O, 'Y' in MC3T, or 'Y' in MC6T)

**EES 2001. Physical Geology. 4 Credit Hours.**

This course is typically offered in Fall, Spring, and Summer I.

Introductory geology course designed for geology and environmental science majors and focused on theory and concepts needed for advanced study. Laboratory sessions (3 hrs/week) focus on the properties of mineral and rock specimens, map skills, and the development of basic field techniques.

**Course Attributes:** SI

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- (except where noted) in (any MATH course numbered 0701 to 0702 (C or higher), any MATH course numbered 0800 to 4999 (may be taken concurrently), 'Y' in MC3, 'Y' in MC4, 'Y' in MC5, 'Y' in MC6, 'Y' in MA01, STAT 1001 (may be taken concurrently), 'Y' in STT2, STAT 1102 (may be taken concurrently), STAT 1902 (may be taken concurrently), 'Y' in MC3A, 'Y' in MC6A, 'Y' in MATW, 'Y' in MC3S, 'Y' in CRMA18, 'Y' in MC3D, 'Y' in MC3O, 'Y' in MC3T, or 'Y' in MC6T)

**EES 2002. Energy and Environment. 3 Credit Hours.**

Energy and Environment examines the scientific principles governing energy technologies and use, and the implications of energy development on our natural resources and environmental quality. The first part of the course will provide an introduction to the basic physical principles behind energy production, existing and emerging energy technologies, and energy use. The second part of the course will provide an understanding of the impacts associated with energy development on land, water and the atmosphere, impact assessment techniques, and interactions among energy, food and water resources. This course will provide an opportunity to become familiar with the future grand challenges in energy development in the context of changing climate and policy scenarios.

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering, Science & Technology.

**Course Attributes:** SE, SF, SS

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- (except where noted) in (any MATH course numbered 0701 to 0702 (C or higher), any MATH course numbered 0800 to 4999 (may be taken concurrently), 'Y' in MC3, 'Y' in MC4, 'Y' in MC5, 'Y' in MC6, 'Y' in MA01, STAT 1001 (may be taken concurrently), 'Y' in STT2, STAT 1102 (may be taken concurrently), STAT 1902 (may be taken concurrently), 'Y' in MC3A, 'Y' in MC6A, 'Y' in MATW, 'Y' in MC3S, 'Y' in CRMA18, 'Y' in MC3D, 'Y' in MC3O, 'Y' in MC3T, or 'Y' in MC6T)

**EES 2011. Mineralogy I. 4 Credit Hours.**

This course is typically offered in Fall.

Fundamentals of hand-specimen analysis including crystallography, bonding, physical properties, chemical composition and growth of common minerals.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in EES 2001 and (CHEM 1031 (may be taken concurrently), CHEM 1041 (may be taken concurrently), or CHEM 1951 (may be taken concurrently))

**EES 2012. Mineralogy II. 4 Credit Hours.**

This course is typically offered in Spring.

Microanalysis by polarized light microscopy, powder x-ray diffractometry and microprobe including site occupancy, crystal growth, and microstructural defects with emphasis on silicates.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in EES 2011.

**EES 2021. Sedimentary Environments. 4 Credit Hours.**

This course is typically offered in Fall and Spring.

Analysis of sediments, physical and biogenic structures, and strata to assess the dynamics of modern and ancient depositional environments. Laboratory and field exercises emphasize data collection, interpretation, and graphic presentation as a means of reconstructing sediment transport mechanisms and depositional settings. NOTE: Required day-long field trips. (Prior to fall 2016, this course was titled "Facies Models.")

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in EES 2001.

**EES 2022. Paleontology and Stratigraphy. 4 Credit Hours.**

This course is typically offered in Spring.

This course provides a working introduction to invertebrate paleontology and the principles of bio-, litho-, and allostratigraphy. Emphasis is placed on combining data from the geological and biological records to understand the sedimentary record through time. Students will gain skill in identifying major invertebrate fossil groups and describing their anatomy, paleoecology, and temporal significance; explore how sedimentological factors influence our understanding of evolution as recorded by the fossil record, and vice versa; and construct measured sections and stratigraphic columns and correlate using multiple stratigraphic techniques. Through two multi-day field trips, students will develop and employ field and map skills while investigating elements of earth history and changes in the tectonic setting of eastern North America through geologic time. NOTE: Two multi-day (including weekends) field trips are required.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in EES 2021.

**EES 2031. Introduction to Field Methods in the Earth and Environmental Sciences. 1 Credit Hour.**

This course is typically offered in Fall.

This course offers a half semester (7-week), intensive introduction to various field methods. Techniques covered will provide a background and foundation to prepare students for both future field courses as well as employment in the environmental industry. Students will learn mapping techniques (geologic and topographic), geologic/soil/water sampling techniques, analysis and understanding of well-log/geophysical data, note taking skills, and the use of a compass to determine location as well as use to determine geologic structures. This course will include multiple field trips. This is a required course for the Certificate in Environmental Professional Training.

**Course Attributes:** SI

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in EES 2001 and EES 2021.

**EES 2051. Introduction to Data Visualization and Analysis for Earth and Environmental Science. 3 Credit Hours.**

This course is typically offered in the Fall.

This course provides an introduction to the management, visualization, and analysis of data sets common to Earth and Environmental Science. Microsoft Excel and Matlab will be introduced and then used to analyze example data sets which introduce and reinforce key algebraic, calculus and physics concepts. Student understanding and skill is developed through projects analyzing stream flow, earthquake populations, plate tectonics and hot spot motion, atmospheric CO<sub>2</sub> concentration, and topography.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in EES 2001 and (MATH 1022 (may be taken concurrently), MATH 1031 (may be taken concurrently), MATH 1038 (may be taken concurrently), MATH 1041 (may be taken concurrently), MATH 1042 (may be taken concurrently), MATH 1044 (may be taken concurrently), MATH 1941 (may be taken concurrently), MATH 1942 (may be taken concurrently), MATH 1951 (may be taken concurrently), 'Y' in MC6, 'Y' in MATW, 'Y' in MC6A, or 'Y' in MC6T)

**EES 2061. Introduction to Geochemistry. 4 Credit Hours.**

This course is typically offered in Fall of odd-numbered years.

Application of chemical principles and quantitative methods to understand and solve various geological problems. Field trips and laboratory exercises will emphasize techniques of obtaining and measuring geological samples. Students will analyze, summarize, and present data in oral and written reports.

**Course Attributes:** SI

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in EES 2001 and (CHEM 1031 or CHEM 1951)

**EES 2065. Nanogeoscience and Technology. 4 Credit Hours.**

This course is typically offered in Fall.

Today, everyone is talking about nanomaterials, even advertisements for consumer products use the prefix "nano" as a keyword for special features. Nanotechnology is one of the most important new technologies of the 21st century. Through this course, history, principles, mechanisms, many exciting phenomena and the processes of nano-scale materials, as well as their applications and environmental impact, will be covered in great detail. The lab component of this course will consist of analyzing nanoparticles in water samples, extracting nanomaterials from consumer products, and monitoring plant growth from soils amended with nanomaterials. Through the course of the lab exercises, students will have hands-on experience on various instruments, including inductively-coupled plasma spectrometry, x-ray diffraction, scanning electron microscopy, and transmission electron microscopy.

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering, Science & Technology.

**Course Attributes:** SF

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in (CHEM 1032 (may be taken concurrently), CHEM 1952 (may be taken concurrently), or CHEM 1035) and (CHEM 1033 or CHEM 1953)

**EES 2067. Introduction to Environmental Toxicology. 3 Credit Hours.**

This course covers fundamental concepts of environmental toxicology, including dose-response, exposure routes, biological variation and toxicity phases. Topics include fate and effects of hazardous substances in organisms and the environment, air pollutants, pesticides, insecticides, aquatic toxicity, endocrine disruptors, biomarkers and bioassays, as well as risk assessment.

**Course Attributes:** SI

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in EES 2061, (CHEM 1032 (may be taken concurrently) or CHEM 1952 (may be taken concurrently)), and (CHEM 1034 (may be taken concurrently) or CHEM 1954 (may be taken concurrently))

**EES 2096. Climate Change: Oceans To Atmosphere. 4 Credit Hours.**

This course is typically offered in Spring.

The major topics in Oceanography will be covered in addition to introducing students to meteorology through the study of the Atmospheric circulation system. These topics will give students a better understanding of climate change and forecasting. The course includes a significant writing project.

**Field of Study Restrictions:** Must be enrolled in one of the following Fields of study: Environmental Science, Earth & Space Sci with Teachin, Geology, Sec Ed-Science Ed.

**Course Attributes:** SE, SF, WI

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in EES 2001.

**EES 2097. Process Geomorphology. 4 Credit Hours.**

This course is typically offered in Fall.

The course explores key Earth surface processes and landforms by examining the role of tectonic and climatic forces, as well as biota, in landscape evolution. The quantitative approach focuses on modern systems in order to reconstruct their ancient counterparts, including their subsurface expression in paleo-landscapes. Culminates in a term project based on original research of active geomorphic systems.

**Course Attributes:** SI, WI

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in EES 2001.

**EES 3001. Igneous and Metamorphic Petrology. 4 Credit Hours.**

This course is typically offered in Fall.

A comprehensive study of Igneous and Metamorphic rocks in both hand samples and thin sections. Understanding of the chemistry, physical properties, global distribution, origin and identification of Igneous and Metamorphic rocks. Lab work will emphasize mineral and rock identification of both hand and thin sections. Thin section production will be introduced. A small group paper and presentation are required, as are day field trips. Scientific literature will be analyzed to examine current issues relating to the Igneous and Metamorphic research.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in EES 2011.

**EES 3011. Remote Sensing and GIS. 4 Credit Hours.**

This course is typically offered in Spring.

The focus of this class is on remote sensing technologies and geographic information systems. Remote sensing is a dynamic field; new, high-resolution satellites are coming online almost daily, and there has been an exponential growth in applications of remote sensing data during the past decade, including: mineral exploration, precision agriculture, watershed management, land use classification, military intelligence, and climate monitoring. The demand for college graduates with experience in this field is growing exponentially as well. By the end of this class you won't be a remote sensing expert, but you will have a fundamental understanding of the uses and limitations of remote sensing data for geologic and environmental applications, as well as fundamental geographic information systems skills.

**Department Restrictions:** Must be enrolled in one of the following Departments: CST: College of Science & Tech, CST:Physics, CST: College of Science & Tech, CST:Biological, CST:Chemistry, CST:Earth & Environmental Sci, CST:Mathematics, CST:Computer & Info Sci, CST:Environmental Sciences, CLA:Geography & Urban Studies, Engineering: Engineering, Engineering: Engineering, Engineering:Civil Engineering, Engineering:Electrical Engineering, Engineering:Mechanical Engineering.

**Class Restrictions:** Must be enrolled in one of the following Classes: Junior 60 to 89 Credits, Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits.

**Course Attributes:** SF

**Repeatability:** This course may not be repeated for additional credits.

**EES 3015. Drone Shortcourse. 1 Credit Hour.**

This course is typically offered in Spring.

Drones are everywhere. This course offers a short introduction to use of drones, otherwise known as unmanned aerial vehicles (UAVs). Students will be taught use of drones in research and other societal applications, basics of flight and operation of drones, and regulations applicable to drone usage. This course does not provide certification to become a drone pilot, but the steps to certification will be reviewed. Flying experience will be provided through labs conducted at the Ambler campus. Students will complete a project involving video or photography using a drone.

**Department Restrictions:** Must be enrolled in one of the following Departments: Tyler:Architect & Env Design, CST: College of Science & Tech, CST:Physics, CST:Biology, CST:Chemistry, CST:Earth & Environmental Sci, CST:Mathematics, CST:Computer & Info Sci, CST:Environmental Sciences, CLA:Geography & Urban Studies, Engineering:Civil Engineering.

**Class Restrictions:** Must be enrolled in one of the following Classes: Junior 60 to 89 Credits, Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits.

**Repeatability:** This course may not be repeated for additional credits.

**EES 3021. Groundwater Hydrology. 4 Credit Hours.**

This course is typically offered in the Spring.

This course provides an introduction to groundwater geology. Topics include how geology influences groundwater flow and geochemistry, how groundwater and surface water interact, and contamination and remediation issues. Student understanding of groundwater and contaminant movement is developed through a series of homework problems and labs that require basic algebra skills.

**Course Attributes:** SF

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- (except where noted) in EES 2001 and (MATH 1022 (C or higher), any MATH course numbered 1038 to 4999 (may be taken concurrently), 'Y' in MC6, 'Y' in MC6A, 'Y' in MA04, 'Y' in MATW, 'Y' in CRMA05, or 'Y' in MC6T)

**EES 3025. Physical Hydrology. 4 Credit Hours.**

This course is typically offered in Fall.

This course examines the physical principles governing the flow of water on and beneath the Earth's surface and the relationship of hydrological processes to other disciplines such as geology, ecology, and atmospheric sciences.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- (except where noted) in EES 2001, (MATH 1022 (C or higher), any MATH course numbered 1038 to 4999 (may be taken concurrently), 'Y' in MC6, 'Y' in MA04, 'Y' in MC6A, 'Y' in MATW, or 'Y' in CRMA05), and (PHYS 1061 or PHYS 1961)

**EES 3042. Coastal Processes and Geomorphology. 4 Credit Hours.**

This course is typically offered in Spring.

The course will apply a process geomorphological approach to understanding coastal behavior. Subjects will include the global distribution of coasts, wave and tidal hydraulics, barrier morphodynamics, nearshore and aeolian sediment transport, and morphological signatures of extreme events.

**Course Attributes:** SI

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in (EES 2021, EES 2042, or EES 2097)

**EES 3065. Nanoscience & the Environment. 4 Credit Hours.**

This course is typically offered in Fall.

Today, everyone is talking about nanomaterials, even advertisements for consumer products use the prefix "nano" as a keyword for special features. Nanotechnology is one of the most important new technologies of the 21st century. Through this course, history, principles, mechanisms, many exciting phenomena and the processes of nano-scale materials, as well as their applications and environmental impact, will be covered in great detail. The lab component of this course will consist of analyzing nanoparticles in water samples, extracting nanomaterials from consumer products, and monitoring plant growth from soils amended with nanomaterials. Through the course of the lab exercises, students will have hands-on experience on various instruments, including inductively-coupled plasma spectrometry, x-ray diffraction, scanning electron microscopy, and transmission electron microscopy.

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering, Science & Technology.

**Course Attributes:** SF

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in (CHEM 1032 (may be taken concurrently), CHEM 1952 (may be taken concurrently), or CHEM 1035) and (CHEM 1033 or CHEM 1953)

**EES 3091. Research Methods. 3 Credit Hours.**

This course is typically offered in Spring.

Research Methods is required for all of the TUteach with Teaching majors. It is one of several content courses specially designed to meet the needs of future teachers. Sections meet two hours per week for non-traditional, interactive lectures and two hours per week for lab. The course is cross-listed in Biology, Chemistry, Earth and Environmental Science, and Physics. The goals of the course are (1) to provide students with the tools that scientists use to solve scientific problems; (2) to give students the opportunity to use these tools in a laboratory setting; (3) to make students aware of how scientists communicate with each other through peer-reviewed scientific literature; and (4) to enable students to understand how scientists develop new knowledge and insights, the most important of which are eventually presented in textbooks and taught in conventional science classes. Students design and carry out four independent inquiries, which they write up and present in the manner that is common in the scientific community. The inquiries incorporate mathematics and the various science disciplines, thus the team of instructors teaching this course have expertise in different disciplines and are available to supervise all students as they work on their inquiries in the lab. The combination of Research Methods and the TUteach course "Perspectives on Science and Mathematics" (Philosophy 2196) provides prospective science and mathematics teachers with an in-depth understanding of how the scientific enterprise works. NOTE: EES 3091 is only available for major credit in the Earth and Space Science with Teaching BS program.

**College Restrictions:** Must be enrolled in one of the following Colleges: Science & Technology.

**Repeatability:** This course may be repeated for additional credit.

**Pre-requisites:** Minimum grade of C- in (SCTC 1289 or SCTC 1389)

**EES 4082. Individual Study Program. 1 to 4 Credit Hour.**

This course is typically offered in Fall, Spring, and Summer I.

Individual independent study and research under supervision of a member of the Earth & Environmental Science Faculty. A final written report will be submitted to the faculty member. For further information and details, see the undergraduate advisor. NOTE: Student must have a GPA of 3.25 at the end of the first semester of their junior year.

**Course Attributes:** SI

**Repeatability:** This course may be repeated for additional credit.

**EES 4101. Structural Geology. 4 Credit Hours.**

This course is typically offered in Spring.

The purpose of this course is to train students in the concepts and techniques of structural geology. Students will learn how to collect, analyze, and interpret geologic data drawn from a variety of disciplines pertinent to structural geology and present a cohesive argument. Results are presented as maps, reports, and computer models. NOTE: Geology B.S. Capstone.

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in EES 2011, EES 2021, and (PHYS 1061, PHYS 2021, or PHYS 2921)

**EES 4200. Topics in Geoscience. 3 Credit Hours.**

This course is not offered every year.

This seminar will allow students to study current problems in geology and environmental science. NOTE: Elective for Earth and Environmental Science majors (Geology and Environmental Science). May be taken multiple times (on different topics) with permission of instructor.

**Repeatability:** This course may be repeated for additional credit.

**EES 4210. Topics in Geoscience with Lab. 4 Credit Hours.**

This course is not offered every year.

This seminar will allow students to study current problems in geology and environmental science. NOTE: Elective for Earth and Environmental Science majors (Geology and Environmental Science). May be taken multiple times (on different topics) with permission of instructor.

**Repeatability:** This course may be repeated for additional credit.

**EES 4502. Ice and Global Climate. 3 Credit Hours.**

We live in a time of rapid global warming and are faced with adverse effects on human society. Ice, in its various forms from snow to ice sheets, plays an important role in the global climate system by, for example, modulating the solar-energy flux and global sea level. Ice also provides a unique archive of past climate history that contributed to our understanding of global warming today. This course will provide an overview of different forms of ice and their role in Earth's climate system, and foundations in physical understanding of how ice behaves at and near Earth's surface. In addition, contemporary techniques in observations of different forms of ice will be explored with examples in processing and interpretation of publicly available datasets.

**Course Attributes:** SE, SF

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in (PHYS 1061, PHYS 1961, PHYS 2021, or PHYS 2921) and EES 2001.



**EES 4589. Field Geology. 6 Credit Hours.**

This course is typically offered in Summer.

The purpose of this course is to train students in the techniques and methodologies of field geology. Students will learn how to collect, analyze, and interpret field data across a variety of geologic disciplines. Results are presented as maps, reports, measured sections, and computer models. NOTE: Students take this course through other institutions. The selection of the camp must be approved by the Geology undergraduate advisor.

**Class Restrictions:** Must be enrolled in one of the following Classes: Junior 60 to 89 Credits, Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits.

**Repeatability:** This course may be repeated for additional credit.

**Pre-requisites:** Minimum grade of C- in EES 2001, EES 2011, EES 2021, and (EES 4096 or EES 4101)

**EES 4696. Vertebrate Paleontology and Taphonomy. 3 Credit Hours.**

This course is typically offered in Fall of odd years.

This course examines vertebrate fossils and their importance for interpreting and reconstructing terrestrial ecosystems. Students will learn the basics of vertebrate skeletal anatomy, interpret transport and depositional histories of skeletal elements and assemblages, and combine this information with geologic data to reconstruct paleoenvironmental settings and paleocommunity associations. Several class sessions will meet off-campus at local museums; one weekend field trip is required.

**Course Attributes:** WI

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in EES 2022.

**EES 4796. Soils and Paleosols. 4 Credit Hours.**

The course is divided into two parts: modern soils and paleosols. The goals of this course are to teach students the fundamentals of modern soil genesis and classification in order to interpret ancient soils preserved in the rock record (paleosols), and to incorporate models of soil genesis into the traditional geology paradigm. Students will be exposed to a combination of laboratory methods and field work.

**Class Restrictions:** Must be enrolled in one of the following Classes: Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits.

**Course Attributes:** WI

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- in EES 2021 and EES 2022 (may be taken concurrently)

**EES 4896. Planetary Geology. 4 Credit Hours.**

This writing-intensive course explores the modern and ancient geologic processes on other planets and discusses how studies of other planets can aid us in a better understanding of our Earth. The course will also cover topics such as planetary exploration and astrobiology and includes a lab.

**Course Attributes:** WI

**Repeatability:** This course may not be repeated for additional credits.

**Pre-requisites:** Minimum grade of C- (except where noted) in (EES 2061, EES 3001, or EES 3096) and (MATH 1041, MATH 1941, MATH 1042 (may be taken concurrently), MATH 1044 (may be taken concurrently), MATH 1942 (may be taken concurrently), MATH 1951 (may be taken concurrently), any MATH course numbered 2043 to 3080 (D or higher; may be taken concurrently), or 'Y' in MATW)