GEOLOGICAL AND ENVIRONMENTAL SCIENCE

Room 2023 Ward Beecher Hall
(330) 941-3616

Chair: Dr. Snjezana "Snow" Balaz (sbalaz@ysu.edu)
Admin: Jill Mogg (jmmogg@ysu.edu)

Welcome

Our **Geological and Environmental Sciences** programs stand out for their hands-on, applied learning approach. Beyond traditional lectures, we integrate PhD-led fieldwork, study abroad options, and faculty-mentored research into the core curriculum.

Analytical Instruments

- Plasma Spectrophotometry
- Ion & Gas Chromatography
- Laser Particle Size Analysis
- High-end SEM/TEM/XRF/XRD access

Remote Sensing & Field Tools

- DJI Matrice 600 Imaging Drone
- Ground Penetrating Radar
- 24-Channel Refraction Seismograph
- Proton Magnetometer & GPS

Professional Pathways

Graduates secure high-paying roles in industry and government or continue to Master's and Doctoral studies in **Geological and Environmental Sciences** fields such as:

- Petroleum Geology
- Environmental Safety
- Public Health
- Engineering Geology
- Hydro-geology
- Regulatory Compliance
- Geophysics
- Mineral Mining

The Clarence R. Smith Mineral Museum
Explore a world-class collection of rare minerals and fossils. Open to the public and free of charge. Visit Museum Website # (https://ysu.edu)

Program Directors & Coordinators

Geology Undergraduate Program
Dr. Beej Spieler | bjspieler@ysu.edu | (330) 941-2293

Environmental Science (UG/Graduate)
Dr. Felicia Armstrong | fparmstrong@ysu.edu | (330) 941-1385

Professor

Felicia P. Armstrong, Ph.D., Professor

Colleen McLean, Ph.D., Associate Professor

Lecturer

Billie Spieler, Ph.D., Lecturer

Part-Time Faculty

Diana M. Alexander, M.S.

Rebecca Baxter, M.S.

Susie L. Beiersdorfer, M.S.

Breanna Beaver, M.S.

Anna C. Woodard (Draa), M.S.

Heidi L. Haug, M.S.

Jessie Holland, M.S.

Thomas E. Jordan, Ph.D.

Tamara M. Kerr-Sahli, M.S.

Daniel J. Kuzma, M.S.

Jason Lee, M.S.

Patrick Pruent, M.S.

Debbie A. M. Smith , M.S.

Majors

- AAS in Environmental Science (https://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-physics-astronomy/aas-environmental-science/)
- BS in Environmental Science (https://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-geological-environmental-sciences/bs-environmental-studies/)

Minors

- Minor in Engineering Geology (https://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-geological-environmental-sciences/minor-engineering-geology/)
- Minor in Environmental Geology (https://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-geological-environmental-sciences/minor-environmental-geology/)
- Minor in Environmental Science (https://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-geological-environmental-sciences/minor-environmental-science/)
- Geoscience Minor (https://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-geological-environmental-sciences/geoscience-minor/)
-

Certificates

- Certificate in Sustainable Environments (https://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-geological-environmental-sciences/certificate-in-sustainable-environments/)

- Certificate in Wastewater (https://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-geological-environmental-sciences/certificate-in-wastewater/)

Geology

GEOL 1500 Environmental Geology 4 s.h.
An introductory course that examines interactions between human society and our changing planet, the affects of natural/geologic hazards on humans, and anthropogenic (human-caused) impacts on nature, geology, and society. Three hours of lecture and two hours lab per week.
Gen Ed: Natural Science, Environ Sustain 2024, Natural Science 2024, Social and Pers Awareness 2024.

GEOL 1503 Rock Studio: Understanding Geology Through Lapidary Experiences 4 s.h.
A discussion and studio-based course designed to develop an understanding and appreciation of earth history, earth physical processes and the formation of rocks and minerals through combined class discussions and creative studio-based discovery experiences. Students learn fundamentals of geology and reinforce their understanding by creating interesting objects and artistic pieces from rocks, minerals and earth materials using a variety of cutting, polishing and basic lapidary equipment. Approximately 3 hrs lecture and 2 hours lab weekly over the course of the term.
Gen Ed: Natural Science 2024.

GEOL 1504 The Dynamic Earth 3 s.h.
An examination of earth as consisting of interrelated geologic systems which are dynamic and constantly changing. Includes study of surface, lithologic and tectonic systems.
Gen Ed: Natural Science, Natural Science 2024.

GEOL 1505 Physical Geology 4 s.h.
A study of the various physical and chemical processes acting on and within the earth, and their products within the context of plate tectonics and their relevance to humans and modern society. The laboratory component includes identification of minerals and rocks, and the interpretation of topographic and geologic maps. Three hours of lecture, two hours of lab per week.
Gen Ed: Natural Science, Natural Science 2024.

GEOL 1505H Honors Physical Geology 4 s.h.
Concepts of the earth as a dynamic planet, investigated through a variety of lectures, text and journal readings, and independent library-research assignments.
Prereq.: Eligibility for the Honors Program or consent of instructor.
Gen Ed: Natural Science, Natural Science 2024.

GEOL 1505L Physical Geology Laboratory 0 s.h.
Physical Geology Laboratory.
Gen Ed: Natural Science Lab.

GEOL 1508 Geology of Gemstones and Allied Minerals 3 s.h.
Formation, occurrence, and distribution of gem materials. Properties and identification of gem stones; factors affecting their value. Introduction to synthetic/artificial gem materials. Not applicable toward the geology major.

GEOL 2600 Geology in the Field 1 s.h.
An experiential field-based course designed to expose students to a variety of geological sites and development projects. Two full day field trips with class room preparation are required.
Prereq.: GEOL 1505 or GEOL 1505H.

GEOL 2602 Introduction to Oceanography 3 s.h.
Survey of geological, physical, chemical, and biological oceanography; description and distribution of properties and their relationship to circulation, shorelines, ocean features, sediments, organisms, and environments.
Gen Ed: Natural Science, Natural Science 2024.

GEOL 2605 Historical Geology 4 s.h.
An in depth study of the origin and evolution of the Earth and its systems and life forms throughout geologic time. The course is designed to develop student critical thinking skills through analysis of concepts and issues, and the integration of maps, lithologic information, and fossil information. Three hours lecture and two hours lab per week. Field trips are an integral part of the course.
Prereq.: GEOL 1505 and GEOL 1505L.

GEOL 2611 Geology for Engineers 3 s.h.
Study of geologic principles, processes, and materials; focus on recognition of geologic factors as they apply to engineering operations and projects. Laboratory work includes examination of minerals, rocks, maps, and case histories. Two hours lecture, two hours laboratory per week.
Gen Ed: Natural Science 2024.

GEOL 2620 Intro to Natural Gas and Water Resources 3 s.h.
A survey of the history, science and technology of oil and gas exploration and production and water resource related issues with an emphasis on non-conventional production in the Appalachian Basin.
Prereq.: MATH 1513, CHEM 1516 and CHEM 1516L.

GEOL 3700 Mineralogy 4 s.h.
The occurrence, composition, and crystallography of common and economically important minerals. Identification of minerals using physical, chemical, optical and x-ray properties. The theory and use of the polarizing microscope and its application to the study of crystalline material, including asbestos materials. Two hours lecture, four hours of lab per week.
Prereq.: CHEM 1515 (may be concurrent) and GEOL 2605.

GEOL 3701 Geomorphology 3 s.h.
A study of landforms and the processes which create them, using aerial photographs, geologic maps, and topographic maps. The laboratory work emphasizes recognition and interpretation of landforms. Two hours lecture, two hours laboratory per week.
Prereq.: GEOL 2605.

GEOL 3702 Glacial Geology 3 s.h.
A study of glacier types: their origin, movement, erosional/depositional contributions, and their relationship to various non-glacial features. Emphasis is on the Pleistocene glacial succession in North America. Field trips are an integral part of the course.
Prereq.: GEOL 2605.

GEOL 3703 Geological Field Methods 2 s.h.
An experiential lecture and field-based course designed to expose students to sites of geological significance and to learn basic field geology methods including data collection, field notebooks, geological feature measurements, and precision surveying methods. The course requires two different two-day field trips with scheduled class meetings to prepare students for the field experiences.
Prereq.: GEOL 2605.

GEOL 3704 Structural Geology 2 s.h.
Description and interpretation of geologic structures, mechanical properties; stress-strain relationships, regional structure of North America, and major tectonic theories. Geology majors must take GEOL 3704L concurrently with GEOL 3704.
Prereq.: GEOL 3701 and GEOL 3718.

GEOL 3704L Structural Geology Laboratory 1 s.h.
Structural geology techniques and analyses, including orthographic solutions, stereographic projections, and interpretation of maps. Two hours lab per week.

Prereq. or Coreq.: GEOL 3704.

GEOL 3705 Structures and Landscapes 4 s.h.
A study of earth surface features and their relationship to rock structure. One or more required field trips. Three hours lecture and three hours lab per week.
Prereq.: GEOL 3700.

GEOL 3706 Geology of Economic Mineral Deposits 3 s.h.
A study of the occurrence, origin, and distribution of mineral deposits, with special attention to their economic use. Field trips are mandatory.
Prereq.: GEOL 3700.

GEOL 3708 Geological Field Methods 2 s.h.
A course designed to develop skills and confidence in field-based sampling, data collection and analysis of results. Two one to two day field trips are required.
Prereq.: GEOL 2600 and 3718 or permission of instructor.

GEOL 3709 Subsurface Investigations 3 s.h.
An introduction to subsurface investigative methods that integrate principles of geophysics, geochemistry, interpretation of well logs and other bore hole data, outcrops and published information in the solution of actual geological problems. Two hours lecture, two hours lab per week. Students are expected to perform field work in addition to regularly scheduled class time.
Prereq.: GEOL 3701; MATH 1571 recommended.

GEOL 3710 Petroleum Geology of the Appalachian Basin 3 s.h.
A survey of the history, science and technology of oil and gas exploration and production within the Appalachian Basin of North America. Course content will focus on conventional and non-conventional exploration and production history, methods, technologies and production. Three hours lecture per week. Field trip mandatory.
Prereq.: GEOL 2605 or permission of instructor.

GEOL 3711 Mineralogy 3 s.h.
Advanced study of the occurrence, classification and processes that lead to the formation of minerals and the rocks and materials in which they occur. Emphasis is placed on the study of rock-forming minerals using physical, chemical and optical properties. Field trip required. Two hours lecture and two hours lab per week.
Prereq.: CHEM 1515 and CHEM 1515L (may be concurrent) and GEOL 2605.

GEOL 3714 Principles of Paleontology 3 s.h.
A detailed study of fossil invertebrates, including their origin, classification, paleoecology and stratigraphic utilization. Two hours lecture and two hours lab per week.
Prereq.: GEOL 2605.

GEOL 3717 Petrology 3 s.h.
A modern approach to understanding rocks within the context of plate tectonics and the use of rocks and minerals as natural resources in support of modern society. Emphasis is placed on investigating the formation, occurrence and classification of igneous, sedimentary and metamorphic rocks using physical, chemical and optical properties. Field Trip Required. Two hours lecture and two hours lab per week. Prereq. GEOL 3711 and CHEM 1516/ CHEM 1516L may be taken concurrently.

GEOL 3718 Igneous and Metamorphic Petrology 4 s.h.
An in-depth study of the petrogenesis of igneous and metamorphic rocks based on their chemical and petrographic characteristics. Three hours lecture, three hours lab per week.
Prereq.: GEOL 3700.

GEOL 3720 Field Investigations in Geology 1-4 s.h.
A field-based approach to the study of geologic concepts and problems. Class and travel supervised by the Geology faculty; location, duration of stay, hours, credit, and grading criteria dependent on the site and nature of the geologic concepts and problems investigated. The course may be repeated. A maximum of 4 s.h. may be applied toward Geology major requirements.
Prereq.: By permit only.

GEOL 3750 Geoscience Seminar 1 s.h.
Guest lecture and student presentation forum course designed to provide students with exposure to a broad range of topics and current research relevant to the geosciences. Course may be repeated.
Prereq.: GEOL 1505.

GEOL 3755 Geological Research Methods and Data Analysis 3 s.h.
This course introduces students to the design and execution project phases applied in the solution of real world geological problems. Emphasis is placed on the recognition of geological problems, the design and execution of research plans and experience with solution-based software commonly used in research and professional practice. Students are required to complete a geological research problem, submit a formal write up and provide an oral and/ or poster presentation.
Prereq.: GEOL 3717.

GEOL 3775 Research Methods for Undergraduates 1 s.h.
This course introduces the student to the fundamental and practical aspects of conducting research. The course emphasizes the scientific method, research methodologies, literature review, writing research proposals, and how research results are presented. Learn the process of developing, funding and conducting research. This course must be taken prior to any undergraduate research.
Prereq.: junior or senior standing.

GEOL 4804 Ground Water 3 s.h.
A study of the geologic and hydrologic factors controlling the occurrence and behavior of water beneath the earth's surface. Two hours lecture, two hours lab per week.
Prereq.: GEOL 2605 and MATH 1571.

GEOL 4806 Engineering Geology 3 s.h.
An introduction to the concepts of engineering geology with an emphasis on the relationship between geologic materials, construction of infrastructure and environmental issues. Topics include case studies that involve rock mass classification, soil classification, and material properties including strength, soil phase relationships, soil consolidation. Required field trip. Three hours lecture.
Prereq.: GEOL 2605 and MATH 1510/MATH 1510C and MATH 1511/ MATH 1511C or permission of instructor.

GEOL 4812 GIS Applications to Geology 3 s.h.
This course covers a variety of geologic applications of GIS software; topics covered include: flood mapping, landslide hazard mapping, modeling soil erosion, watershed delineation, etc. Although you will be exposed to the basic functions of ArcGIS, the course is designed primarily to provide experience in obtaining, managing, interpreting, displaying, and presenting geo-spatial data in a meaningful context.
Prereq.: GEOL 3701, GEOG 2611.

GEOL 4820 Water Pollution Control 3 s.h.
Sources and prevention methods of water pollution, human activities and natural conditions that influence water quality, protection methods and regulations of water quality, contamination and remediation of groundwater.
Prereq.: GEOL 1505 or ENST 2600.

GEOL 4824 Tectonics 3 s.h.
Geodynamics and the workings of plate tectonics. Kinetics and dynamics of plate motion, plate driving forces, thermal structure of the earth, and thermal convection in the earth. Tectonic and structural features on the earth. Geophysical, stratigraphic and structural signatures of extensional rifting, strike-slip faulting, subduction zones, plate collisions and mountain belts.
Prereq.: GEOL 3704.

GEOL 4825 Geophysical Well Log Analysis 3 s.h.
An introduction to geophysical well logging, analysis, and interpretation applications in the oil and gas industry. Topics include well construction, drilling mud properties, and interpretation of gamma ray, SP, resistivity, sonic, neutron density, and cement bond logs. Restrictions: permission of instructor.
Prereq.: GEOL 2620, GEOL 3704, PHYS 1502 or PHYS 2611.

GEOL 4830 Senior Thesis 4 s.h.
Designed to be completed during the student's senior year and is expected to be a significant research-based contribution to the geosciences. A typical senior thesis topic will support the research program of full-time GES faculty. Students may develop their own research topic provided they have the support of one or more full-time GES faculty.
Prereq.: Junior standing, minimum cumulative GPA of 3.0, submission of approved research proposal, permission of GES Chairperson.
Gen Ed: Capstone 2024.

GEOL 4899 Special Topics 1-3 s.h.
Selected aspects of geology not covered in existing courses. Topics to be announced each time course is offered. May be repeated for different topics. Restrictions: appropriate 3700- or 4800- geology course and permission of the chairperson.
Prereq.: none.

GEOL 5802 Sedimentology and Stratigraphy 3 s.h.
The study and interpretation of sedimentary rocks, including physical characteristics, petrography, depositional environments, principles of correlation, and principles of basin analysis. Two hours lecture, two hours lab per week.
Prereq.: GEOL 3704.
Gen Ed: Capstone 2024.

GEOL 5805 Special Problems in Geology 1-4 s.h.
An in-depth study of a specific problem in one of the branches of geology. The problem depends on the student's interest and qualifications and the equipment availability. A maximum of 8 s.h. may be taken.
Prereq.: 8 s.h. in Geology, consent of the department chairperson and instructor.

GEOL 5810 Groundwater Resource Evaluation 3 s.h.
Geologic and hydrologic interpretation of groundwater data with emphasis on regional groundwater resources, groundwater management, groundwater supplies, and design and construction of water wells.
Prereq.: GEOL 2605 or permission of instructor.

GEOL 5815 Geology and the Environment 2 3 s.h.
In-depth examination of earth processes, earth resources, and properties of earth materials as they relate to human activities, and their geologic consequences.
Prereq.: GEOL 2615 or ENST 2600.

GEOL 5817 Environmental Geochemistry 3 s.h.
An application of low-temperature aqueous geochemistry and geochemical computer modeling to environmental problems such as acid mine drainage, geochemical cycling of trace elements and nutrients, hazardous waste remediation, nuclear waste disposal, and surface and ground-water contamination.
Prereq.: GEOL 3700 and CHEM 1516.

Environmental Studies

ENST 1500 Introduction to Environmental Science 3 s.h.
Basic environmental science literacy for informed citizens as inhabitants and stewards of Earth. The use of science and the scientific method to understand, assess, and manage the environment to improve human health, conserve energy and resources, preserve nature, and sustain quality of life.
Gen Ed: Natural Science, Environ Sustain 2024, Natural Science 2024, Social and Pers Awareness 2024.

ENST 1500L Introduction to Environmental Science Lab 1 s.h.
The use of the scientific method to explore various fields in environmental science including water quality, risk assessment, biodiversity and mineral uses. This field and laboratory work supplements ENST 1500.
Prereq. or Coreq.: ENST 1500.
Gen Ed: Natural Science Lab.

ENST 1502 Environmental Sustainability 3 s.h.
This course will introduce students to the science of sustainability. It includes an overview of the origins of the concept of environmental sustainability and the development of sustainability science as an independent discipline and investigates the methodologies used by scientists to develop sustainable systems. The course also will explore the sustainability of technological advances in global food production. Topics include the origins of agriculture, soil energy and conservation, industrial vs. organic agriculture, integrated pest management, genetically modified organisms (GMOs), and biofuels. An overview of various renewable and non-renewable energy resources, their distribution, availability, patterns of use, and impact on the environment will be addressed. Students will evaluate relative energy efficiencies, as well as political and economic impacts on energy.
Prereq.: None.

ENST 1503 Environmental Field Biology 4 s.h.
Instrumental analysis of samples from aquatic systems involving automated calorimetry, atomic absorption spectrophotometry, gas chromatography, ion chromatography and high-performance liquid chromatography. Students will learn basic analytical techniques and apply them in group projects investigating real world water quality problems. Three hours lecture, two hours lab.
Prereq.: ENST 1500.

ENST 1504 Environmental Occupational Health and Safety 3 s.h.
Provides an overview of the field of occupational health, with a focus on the impact that chemical, physical, and biological agents have on the public's health and the environment. Presents information related to the recognition, evaluation and control of the chemical, physical and environmental factors that can impact human health. Establishment and maintenance of safety programs are discussed. Collection, analysis and interpretation of safety data are considered. Approaches to safety used by international, national and local governmental agencies are reviewed, as well as recognition, evaluation, and control of occupational safety and health hazards (chemical, physical) that may cause injury and/or illness or cause significant discomfort to employees, or residents of the community.
Provides an overview of the field of occupational health, with a focus on the impact that chemical, physical, and biological agents have on the public's health and the environment. Presents information related to the recognition, evaluation and control of the chemical, physical and environmental factors that can impact human health. Establishment and maintenance of safety programs are discussed. Collection, analysis and interpretation of safety data are considered. Approaches to safety used by international, national and local governmental agencies are reviewed, as well as recognition, evaluation, and control of occupational safety and health hazards (chemical, physical) that may cause injury and/or illness or cause significant discomfort to employees, or residents of the community. **Prereq.:** none.

ENST 1506 Environmental Principles of Water Resources 4 s.h.
This course will cover the components of a water-quality study within the focus of a watershed. Design concepts for environmental studies, aspects of data analysis, key chemical and biota indicators will be discussed. This course will also cover issues with potable water resources, including the treatment of drinking water and the post-treatment of waste water. Other topics covered will include the impacts of both urban water runoff and agricultural uses of water with a thorough review of the Clean Water Act that governs such policy, as well as Section 404 of the CWA permitting discharge to waters of the United States, including wetlands.
Prereq.: none.

ENST 1508 Environmental and Natural Resource Policy 3 s.h.
Historical, ethical, economic, legal, and policy aspects of environmental science are analyzed with an emphasis on their interrelationships. Various strategies of pollution abatement are considered.
Prereq.: none.

ENST 1509 Hazardous Waste 3 s.h.
This course will cover both solid, liquid, and hazardous waste. Technology, health, and policy issues associated with solid waste and hazardous materials are examined. Methods of managing solid and hazardous waste are introduced, and regulations are presented where appropriate. The characteristics of hazardous and solid waste materials, health frameworks, and the distribution of contaminants in the environment are reviewed. The course is extremely broad in scope spanning laws, regulations, treatment technologies, and risk assessment. While treatment technologies are presented and basic process design information is covered, the course is designed for breadth, not depth, in process design and hazardous waste management. The objective of the course is to provide a comprehensive and historical overview of hazardous waste management, drawing from both scientific and engineering principles, and prepare our students to be well-qualified and competitive in the responsibility of engineering design and permitting in the field of hazardous waste management.
Prereq.: None.

ENST 1510 Green Infrastructure 3 s.h.
This course will focus on green infrastructure as it pertains to increasing eco-friendly alternatives to outdated infrastructure with the preservation of water and soils as the major goal. Green infrastructure including urban planning, small community planning of green spaces, rain gardens, eco-roofs, and porous pavement, will mimic the natural water cycle and provide additional social, economic, and environmental benefits. This online course features case studies, demonstration projects, and interactive tools to prepare both novice and experienced professionals with the knowledge and resources they need for successful green infrastructure implementation A particular area of focus will be the relationship between green infrastructure for improving hydrology and riparian corridors as part of comprehensive green space planning for recreation and cultural resources. The course will look at a wide range of systems including water, transportation, and food systems.
Prereq.: none.

ENST 1511 Social-Ecological Systems and Sustainability 3 s.h.
This course will cover the unprecedented environmental challenges largely as a consequence of unsustainable interactions with nature. In this course, we will explore themes related to the essentiality of biodiversity to ecosystem services, working with nature, biophilic design, permaculture and multifunctional agricultural landscapes, and collaborative decision-making, and use the tools of systems thinking and dynamics to explore linked socio-ecological systems. The class will explore the unintended environmental consequences of modern life after historical industrialization. The unintended consequences at the expense of natural resources, energy, and pollution-intensive food production, and the economic system's failure to work effectively within a socio-ecological system will be explored. Using evidence-based science, students will identify actionable strategies for sustainability.
Prereq.: none.

ENST 1515 Waste Management 3 s.h.
This course is designed to enable the learner to understand the main sources from where waste is derived, to appreciate the problems associated with waste disposal, to analyze waste reduction methods during the production phase and during the disposal cycle of a product, and to be aware of the move towards waste minimization techniques and the resulting overall benefits these will provide society. The student will acquire a range of practical skill and knowledge to be able to apply waste reduction methods in their own environment and also to an industrial/business enterprise.
Prereq.: None.

ENST 2600 Foundations of Environmental Science 3 s.h.
A survey of the principles and issues of environmental studies including basic ecology, biodiversity, hazardous and solid waste management, sustainable development, energy production and conservation, environmental ethics, air, water and soil pollution.

ENST 2600L Foundations of Environmental Science Laboratory 1 s.h.
Laboratory and field investigations identified in ENST 2600. Emphasis on the scientific method, problem solving and critical thinking skills in environmental assessment techniques, active exploration of environmental concerns and their solutions. Three hours per week. Field trips may require additional time past the scheduled lab time.
Prereq. or Coreq.: ENST 2600.

ENST 2606 Global Perspectives in Alternative Energy Sources 3 s.h.
This course will provide a global perspective to society's present needs and future energy demands. This course will provide an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternative energy sources, their technology and application. The course will examine conventional energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternate, renewable energy sources such as solar, biomass (conversions), wind power, geothermal and hydroelectrical power.
Prereq.: none.

ENST 2620 Seminar 1 1 s.h.
This one-credit hour course introduces students early in their academic careers, as well as newly transferred students, to the interdisciplinary nature of environmental science. Invited speakers will present on various topics in environmental science and career paths. Students will develop foundational skills through guided scientific literature searches and introductory scientific writing. Active components of the course include online database searches, proper citation methods, and basic instruction in the use of Microsoft Word, Excel and PowerPoint.
Prereq.: None.

ENST 2650 Independent Study 1-3 s.h.
The introductory study of problems or issues in Environmental Studies or a review of the literature relating to a specific environmental topic. May be repeated for different topics for a total of 6 s.h.
Prereq.: Permission of the director.

ENST 3700 Environmental Chemistry 4 s.h.
Study of the fundamental chemical principles underlying common environmental problems, including water pollution, toxicology, chemical biotransformation and degradation. Chemistry of pesticides, petroleum hydrocarbons and heavy metals are also investigated.
Prereq.: ENST 2600 and CHEM 1516.
Coreq.: ENST 3700L.

ENST 3700L Environmental Chemistry Lab 0 s.h.
Students will investigate various analytical and instrumental techniques used in the examination of chemicals in environmental media (soil, water, biota). Includes proper handling, storage and precautions in the laboratory and the environment. Taken with ENST 3700.

ENST 3730 Air Quality 3 s.h.
Sources, dispersions, consequences and abatement of air pollutants emanating from industry and transportation. Topics also include the history, legislation, standards and economics of air pollution.
Prereq.: CHEM 1515.

ENST 3750 Seminar 2 1 s.h.
Guest lecturers will explore contemporary environmental issues, including current research, application of technology, strategies to reduce environmental impact, environmental ethics, policy, etc. Students are required to present a short seminar on an approved topic. Junior or senior standing.
Prereq.: C or better in ENST 2600 and ENST 2620.

ENST 3751 Water Quality Analysis 3 s.h.
Introduction to physical, chemical, and biological measurements of water quality. Sample collection and laboratory analysis of natural waters, drinking water, and wastewater. Interpretation of environmental data. Two hours lecture and three hours laboratory per week. Identical to CEEN 3751.
Prereq.: CEEN 3736 OR ENST 2600; CHEM 1515.

ENST 3751L Water Quality Analysis Lab 0 s.h.
Laboratory experience in the analysis of natural waters, drinking water and wastewater. Emphasizes procedures for the collection and interpretation of data on current environmental problems. Three hours laboratory per week. Must be taken concurrently with ENST 3751. Identical to CEEN 3751.).
Prereq.: Must be taken concurrently with ENST 3751 (Note: already in course description.

ENST 3752 Soil Quality and Analysis 3 s.h.
Soil is an important environmental medium that must be analyzed to assess quality standards. Students develop the ability to conduct laboratory experiments and to critically analyze and interpret soil data. Furthermore, this course contributes to the background knowledge students need to assess environmental impact and risk, sustainability, health and safety.
Prereq.: CHEM 1515 and CHEM 1515L or equivalent.

ENST 3775 Research Methods for Undergraduate 1 s.h.
This course introduces the student to the fundamental and practical aspects of conducting research. The course emphasizes the scientific method, research methodologies, literature review, writing research proposals and the presentation of research results. Students will gain valuable experience in identifying a problem, developing a research plan and summarizing results. This course must be taken prior to engaging in undergraduate research.
Prereq.: junior or senior standing.

ENST 3780 Environmental Research 2-4 s.h.
A research project that involves problem identification, hypothesis formation, experimentation, data analysis and interpretation. The research may be either basic or applied.
Prereq.: Junior or Senior standing, ENST major or minor, and permission of the Program Coordinator.

ENST 3781 Environmental Sampling Methods 3 s.h.
Sampling design, including number and types of samples and procedures for taking representative samples of air, water, soil and contents of storage and shipping containers. Two hours of lecture, three hours of laboratory.
Prereq.: C or better in ENST 2600/ENST 2600L.

ENST 3784 Research Experience in Environmental Science 4 s.h.
This capstone course will give student the experience in the planning and execution of a research project. Graduate schools and research establishments consider an undergraduate student research experience as extremely valuable. Research provides students with an opportunity to work with faculty and graduate students on more advance research topics. Research furthers our knowledge of basic environmental science and helps us find solutions to environmental problems. The process improves student skills in gathering data, brainstorming ideas, evaluating data, and discussing the results to others through written and oral presentations. Environmental research can be focused on fieldwork, computer simulation, or laboratory analysis. Course open to Junior or Seniors majoring in Environmental Science.
Prereq.: C or better in ENST 3751 and ENST 3751L or ENST 3752 or ENST 4851 and ENST 4851L.

ENST 3790 Internship/Cooperative 1-4 s.h.
Students work under the direction of a faculty supervisor in a governmental agency or in the private sector as environmental specialists. An activities log and summary report are required. The course may be repeated.
Prereq.: Junior standing in ENST and permission of the director.

ENST 4801 Sources of Contamination 3 s.h.
A study of the sources and fate and transport of air, water, and soil contaminants that have potential to adversely affect human health and the environment. Topics will include measurement of environmental parameters, data collection and reporting, interpretation of results, compliance issues, and economic implications.
Prereq.: 20 sh of ENST, BIOL, GEOL, CHEM or combination.

ENST 4822 Water Pollution Control 3 s.h.
Sources and prevention methods of water pollution, human activities and natural conditions that influence water quality, protection methods and regulations of water quality, contamination and remediation of groundwater. 3.s.h.
Prereq.: GEOL 1505 or ENST 2600.

ENST 4840 Topics 1-3 s.h.
Independent study of special topics not included in available courses. Students do extensive reading in, and write a formal report on, a specific area of Environmental Studies.
Prereq.: Junior standing or consent of instructor.

ENST 4851 Soil and Water Quality & Analysis 4 s.h.
Introduction to physical, chemical, and biological measurements of water and soil quality. Sample collection and laboratory analysis of soils, natural waters, drinking water, and wastewater. Interpretation of environmental data. Three hours lecture and three hours laboratory per week.
Prereq.: "D" or better in CHEM 1515 and CHEM 1515L or equivalent.
Coreq.: ENST 4851L.

ENST 4851L Soil and Water Quality & Analysis Lab 0 s.h.
Laboratory methods associated with the determination of physical, chemical, and biological measurements of water and soil quality. Sample collection and laboratory analysis of soils, natural waters, drinking water, and wastewater. Interpretation of environmental data. Three hours lecture and three hours laboratory per week.
Prereq.: "D" or better in CHEM 1515 and CHEM 1515L.
Coreq.: ENST 4851.

ENST 4890 Environmental Science Capstone 3 s.h.
This capstone course serves as the culminating experience for students in environmental science. It is designed to demonstrate advanced knowledge in environmental science and the ability to apply critical thinking skills through an extended written discussion of an environmentally related topic. In this culminating project, students research and analyze a real-world issue in environmental science. The primary goal is to apply the knowledge skills and abilities gained throughout the program in a practical and comprehensive way. This capstone requires two key components: a written report and a final presentation. Senior standing in Environmental Science or permission of instructor.
Prereq.: C or better ENST 3751 and ENST 3751L or ENST 3752 or ENST 4885 and ENST 4885L.

ENST 5800 Environmental Impact Assessment 3 s.h.
Analysis of the potential environmental effects resulting from the construction of buildings, highways, parking lots, mines, reservoirs, and waste disposal facilities. Standard procedures are taught for evaluating and reporting the environmental impact of these activities.
Prereq.: junior or senior standing and 6 sh of >ENST 3700 courses.

ENST 5810 Environmental Safety 3 s.h.
The proper use of environmental monitoring instruments and personal protective gear. Participation in a series of realistic, hands-on simulation exercises that address a variety of waste clean-up situations. Topics include chemical and physical hazards of chemical compounds and toxicology and adverse effects of chemical exposure. Class meets three hours per week. Successful completion of the course earns OSHA Hazwoper 40 hour training certificate.
Prereq.: ENST 2600, equivalent experience or permission of instructor.

ENST 5815 Fundamentals of Industrial Hygiene 3 s.h.
This course is designed as an introduction to the basic concept of industrial hygiene and to provide students with a broad understanding of the field. Major emphasis of the course will be recognition of hazards in the workplace which may cause sickness, impaired health or well-being. Evaluation or measurement of those hazards and application of control strategies. May require permission of instructor.
Prereq.: CHEM 1515 or equivalent.

ENST 5820 Sustainability, Climate Change, and Society 3 s.h.
This course explores environmental, economic, and social aspects of sustainable development, with an emphasis on economy and society. Through topics such as water, food, and climate change, we examine the role of humans and institutions in sustainable development and possibilities for reconfiguring relationships between our institutions and the natural world.
Prereq.: junior, senior or graduate level standing.

ENST 5830 Toxicology and Risk Assessment 3 s.h.
A study of environmental toxicology of chemicals, primarily anthropogenic pollutants, and their effect on humans and ecosystems. Includes transportation of pollutants in the environment, biochemical reactions, toxicity testing methods, and dose-response assessment. Continues with an introduction in the process of estimating risk and the perception of those risks including how risk is used to set environmental standards.
Prereq.: junior or senior with 9 semster hours in 3700 level or above in ENST, CHEM, BIOL, GEOL or CEEN.

ENST 5860 Environmental Regulations 3 s.h.
An examination of federal and state regulations that relate to cleanup of abandoned waste sites, management of waste from current waste generators, development of new hazardous products and chemicals, safety and health issues, and control of pollution into air and water.
Prereq.: ENST 2600 or equivalent.