Environmental Sciences (ES)

Environmental Sciences (ES) Courses

**ES 5013. Survey Topics in Environmental Science. (3-0) 3 Credit Hours.**
Prerequisite: Graduate standing. Analysis of the basic concepts and new scientific developments in environmental science. Case studies will cover a range of relevant topics to promote a thorough understanding of the emergent issues in environmental science. Emphasis will be placed on developing both written and verbal scientific presentation skills. (Formerly EES 5013. Same as BIO 5013. Credit can be earned for only one of the following: BIO 5013, EES 5013, or ES 5013).

**ES 5023. Experimental Design and Analysis. (3-0) 3 Credit Hours.**
Prerequisite: Graduate standing. A course designed to give graduate students the skills necessary to write a manuscript for peer review and to present professional materials for publication. Fundamental concepts of the statistical design and analysis of environmental experiments will be presented. Students will be required to prepare other professional materials for presentation or publication. (Course cannot be used for graduate credit by students in ES 5213 and ES 5213). (Formerly EES 5023. Credit cannot be earned for both EES 5023 and ES 5023.) (Formerly EES 5023. Same as GEO 5023 and CE 5043. Credit can be earned for only one of the following: EES 5023, ES 5023, GEO 5023, or CE 5043).

**ES 5033. Fundamentals of Environmental Law. (3-0) 3 Credit Hours.**
Prerequisite: Graduate Standing. This course exposes students to basic legal theories relevant to contemporary environmental practice, and provides an introduction to administrative law as well as federal environmental statutes: the Clean Air Act, Clean Water Act, National Environmental Policy Act, Endangered Species Act, Resource Conservation and Recovery Act, and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

**ES 5043. Technical Writing for Environmental Scientists. (3-0) 3 Credit Hours.**
Prerequisite: Graduate standing. A course designed to give graduate students the skills necessary to write a manuscript for peer review and to prepare other professional materials for presentation or publication. Topics covered in this course include: searching the scientific literature; scientific writing style; writing graduate level papers, proposals, projects, and thesis components; preparing scientific presentations; presentation of data; using visual aids; and using word processing, spreadsheet, and presentation software.

**ES 5044. Urban Environmental Planning and Sustainability. (3-0) 3 Credit Hours.**
This course examines how the concept of sustainable development applies to buildings, cities and urban regions and gives students insight into a variety of contemporary urban planning and green building issues through the sustainability lens. Ways to coordinate goals of environmental, economic, and social equity at different scales of planning are addressed, including the region, the city, the neighborhood, the site, and buildings.

**ES 5053. Environmental Geology. (3-0) 3 Credit Hours.**
Prerequisite: GEO 4063 or consent of instructor. Geologic materials and processes as related to their influence on the human physical environment. Effects of landscape modification and geologic hazards such as earthquakes and landslides. Properties of minerals, rocks, and soils and geologic aspects of waste disposal and water resources are examined. (Course cannot be used for graduate credit by students in Geology.) (Formerly EES 5213. Credit cannot be earned for both EES 5213 and ES 5213).

**ES 5063. Environmental Microbiology. (3-0) 3 Credit Hours.**
Prerequisite: BIO 3713 or consent of instructor. To provide a basic understanding of environmental microbiology primarily from two aspects: microbial interactions with chemical pollutants in the environment and the fate of microbial pathogens in the environment. Topics covered include microbial environments, detection of bacteria and their activities in the environment, microbial biogeochemistry, bioremediation, and water quality. (Formerly EES 5063. Same as BIO 5063 and CE 5203. Credit can be earned for only one of the following: BIO 5063, CE 5203, BIO 5043, or GEO 5043).

**ES 5073. Applied Ecology. (3-0) 3 Credit Hours.**
The impact of humanity’s activities on the environment: their effect on water, land, animal, and human resources. An evaluation of present and future strategies to preserve a healthy environment. (Formerly EES 5103. Credit cannot be earned for both EES 5103 and ES 5103).
ES 5493. Water Pollution Control. (3-0) 3 Credit Hours.
Principles and methods of water pollution control process design and operation; selection and optimization of total treatment processes as well as appurtenances and accessory equipment; and methods involved in the design process and the selection of the hardware. (Formerly EES 5493. Credit cannot be earned for both EES 5493 and ES 5493).

ES 5503. Policy and Principles of Environmental Law. (3-0) 3 Credit Hours.
Prerequisite: ES 3203 or ES 5133, or equivalent. This course exposes students to advanced policies and principles relevant to contemporary environmental practice, and provides advanced knowledge of the six federal environmental statutes: the Clean Air Act, Clean Water Act, National Environmental Policy Act, Endangered Species Act, Resource Conservation and Recovery Act, and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). (Same as PAD 5483. Credit can be earned for only one of the following: EES 5503, ES 5503, or PAD 5483).

ES 5623. Environmental Chemistry. (3-0) 3 Credit Hours.
This course explores the chemistry of the environment, the chemistry underlying environmental problems and solutions to environmental problems. Emphasis is placed on thermodynamics and kinetics of reaction cycles; sources, sinks and transport of chemical species; and quantitation of chemical species. Examples are selected from the chemistry of natural and contaminated air, water, and soil. (Same as CE 5613. Credit cannot be earned for both ES 5623 and CE 5613).

ES 5753. Conservation and Restoration Ecology. (3-0) 3 Credit Hours.
The class topics will include the nature of the biosphere, threats to its integrity, and ecologically sound responses to these threats. Also included will be the origin and preservation of biotic diversity, how the rich variety of plant and animal life arose, how it has been maintained by natural processes, and how its destruction can be prevented. (Same as BIO 5753. Credit cannot be earned for both BIO 5753 and ES 5753).

ES 5763. Ornithology. (3-0) 3 Credit Hours.
A course covering various aspects of the biology of birds, including anatomy, physiology, systematics, evolution, behavior, ecology, and biogeography. Field trips may be included. (Same as BIO 5713. Credit cannot be earned for both BIO 5713 and ES 5763).

ES 5773. Wildlife Ecology. (3-0) 3 Credit Hours.
An introduction to wildlife management including ecological principles dealing with ecosystems, natural communities, and populations. The importance of animal behavior, the availability of food, cover, wildlife diseases, predators, hunting, and trapping will be included. Field trips may be included. (Same as BIO 5793. Credit cannot be earned for both BIO 5793 and ES 5773).

ES 5783. Evaluation and Valuation of Ecosystem Services. (3-0) 3 Credit Hours.
This course will examine the flow of goods and services provided by the ecosystem that are important to sustaining human well-being. The value of ecosystem goods is generally set by trading the market place, while the value of ecosystems services is often ignored, yet also important in sustaining human well-being. This course will explore methods to evaluate and value these ecosystem services.

ES 5793. Environmental Remediation. (3-0) 3 Credit Hours.
Prerequisite: CHE 2603 or an equivalent. This course will focus on the fundamentals associated with environmental remediation in relation to overall environmental quality and protection. Topics covered include contaminant fate and transport; physical, chemical, and biological processes/characteristics of the air, soil, and water; remediation/ restoration methods; environmental monitoring; environmental assessments; environmental regulations; and water/wastewater treatment.

ES 5971. Directed Research. (0-0) 1 Credit Hour.
Prerequisites: Graduate standing and permission in writing (form available) of the instructor and the student’s Graduate Advisor of Record. The directed research course may involve a laboratory, field-based, or theoretical problem. May be repeated for credit, but not more than 3 hours, regardless of discipline, will apply to the Master’s degree. (Formerly EES 5971-3).

ES 5973. Directed Research. (0-0) 3 Credit Hours.
Prerequisites: Graduate standing and permission in writing (form available) of the instructor and the student’s Graduate Advisor of Record. The directed research course may involve a laboratory, field-based, or theoretical problem. May be repeated for credit, but not more than 3 hours, regardless of discipline, will apply to the Master’s degree. (Formerly EES 5971-3).

ES 5981. Graduate Seminar in Environmental Science and Engineering. (1-0) 1 Credit Hour.
Prerequisite: Graduate standing in the program or consent of instructor. Topical issues of current research will be examined. Presentations will be by current faculty, invited guests and Master’s or Doctoral candidates. May be repeated for credit but only 2 hours may be applied toward the Master’s degree. The grade report for this course is either “CR” (satisfactory) or “NC” (unsatisfactory). (Formerly EES 5981 and ES 5991).

ES 6043. Soil Chemistry. (3-0) 3 Credit Hours.
Prerequisites: CHE 1113 and CHE 2603. Overview of basic soil science and soil chemistry. Examination of the interactions between soil solids, precipitates, and solution phases will include mineralogy, ion exchange, adsorption/desorption, soil colloid behavior, acidic/basic soils, salinity, solid/solution phase interactions, and biological features.

ES 6053. Sustainability and Renewable Energy. (3-0) 3 Credit Hours.
Prerequisite: Graduate standing. This course provides an introduction to energy systems and renewable energy resources. It will be a scientific examination of the energy field and an emphasis on alternate energy sources, their technology, application, and how they can lead to a more sustainable future. The class will explore society’s present needs and future energy demands, examine conv.

ES 6103. Environmental Assessment. (3-0) 3 Credit Hours.
Prerequisite: Graduate standing. This course evaluates the framework of an impact assessment and details regarding the environment (air, water, soil), its pollutants (atmospheric, noise, water, solid waste), their impacts (physical, social, economic), relevant regulations, and pollution minimization or management strategies. Students will use this information to prepare a hypothetical Environmental Impact Statement (EIS). (Formerly EES 6103 and ES 5203. Credit can be earned for only one of the following: EES 6103, ES 5203, or ES 6103.).
ES 6113. Advanced Plant Physiology. (3-0) 3 Credit Hours.
Principles of plant physiology and biochemistry, with particular emphasis on plant hormones, nitrogen fixation, plant respiration, photosynthesis, and current research work. (Formerly EES 6113. Same as BIO 6113. Credit can be earned for only one of the following: BIO 6113, EES 6113, or ES 6113).

ES 6133. Methods in Field Ecology. (3-0) 3 Credit Hours.
Prerequisite: BIO 3283 or an equivalent. Examination of techniques to collect, identify, and preserve plants and animals. Field methods used in the analysis of populations and communities are considered. (Formerly EES 6133. Same as BIO 6133. Credit can be earned for only one of the following: BIO 6133, EES 6133, or ES 6133).

ES 6213. Advanced Ecology. (3-0) 3 Credit Hours.
Prerequisite: BIO 3283 or an equivalent. Interaction of organisms with their environment, allelopathy, competition, distribution, succession, and factors that control growth and dispersal. Special consideration is given to the concepts of climax, succession, and land management. (Formerly EES 6213. Same as BIO 6213. Credit can be earned for only one of the following: BIO 6213, EES 6213, or ES 6213).

ES 6273. Analyses of Environmental Problems. (3-0) 3 Credit Hours.
Problems will be presented and potential solutions will be explored from a variety of areas including soil, air, water, coastal and marine systems. Also examined will be potential impact on biotic and abiotic resources in terrestrial, aquatic and marine systems. (Formerly EES 6273. Credit can be earned for only one of the following: CE 6273, EES 6273, or ES 6273).

ES 6723. Application of Federal Environmental Law at the State Level. (3-0) 3 Credit Hours.
Prerequisite: ES 5503. This course exposes students the application of federal laws at the State level. The course will provide information on how environmental laws should be enforced, and whether the state or federal government should have the final word in specific environmental debates. (Formerly EES 6723. Credit can be earned for only one of the following: CE 6723, EES 6723, or ES 6723).

ES 6813. Water Resources. (3-0) 3 Credit Hours.
Application of management principles to the efficient use of water resources by people and their public and private institutions. Water is examined in terms of its value, use, and changing role in the context of economics, history, politics, and technology. (Formerly EES 6813. Same as GEO 6813. Credit can be earned for only one of the following: EES 6813, ES 6813, or GEO 6813).

ES 6941. Environmental Science Colloquium. (1-0) 1 Credit Hour.
Prerequisite: Graduate standing. Discussions of current journal articles, reviews, and recent advances in specialized areas of the biological sciences. May be repeated for credit as topics vary. The grade report for this course is either “CR” (satisfactory participation in the colloquium) or “NC” (unsatisfactory participation in the colloquium). (Formerly EES 6941. Same as BIO 7041. Unless topic varies, credit can be earned for only one of the following: BIO 7041, EES 6941, or ES 6941).

ES 6951. Independent Study. (0-0) 1 Credit Hour.
Prerequisites: Graduate standing and permission in writing (form available) of the instructor and the student’s Graduate Advisor of Record. Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students needing specialized work not normally or not often available as part of the regular course offerings. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to the Master’s degree. (Formerly EES 6951-3).

ES 6953. Independent Study. (0-0) 3 Credit Hours.
Prerequisites: Graduate standing and permission in writing (form available) of the instructor and the student’s Graduate Advisor of Record. Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students needing specialized work not normally or not often available as part of the regular course offerings. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to the Master’s degree. (Formerly EES 6951-3).

ES 6961. Comprehensive Examination. (0-0) 1 Credit Hour.
Prerequisite: Approval of the appropriate Graduate Program Committee to take the Comprehensive Examination. Independent study course for the purpose of taking the Comprehensive Examination. May be repeated as many times as approved by the Graduate Program Committee. Enrollment is required each term in which the Comprehensive Examination is taken if no other courses are being taken that term. The grade report for the course is either “CR” (satisfactory performance on the Comprehensive Examination) or “NC” (unsatisfactory performance on the Comprehensive Examination). (Formerly EES 6961).

ES 6963. Internship. (0-0) 3 Credit Hours.
Prerequisites: Graduate standing and consent of Graduate Advisor of Record. An opportunity for students to work in a setting that permits them to apply what they have learned in the formal instruction part of the program. May be repeated for credit, but not more than 3 hours will apply to the Master’s degree. (Formerly EES 6963. Credit cannot be earned for both EES 6963 and ES 6963).

ES 6973. Special Problems. (3-0) 3 Credit Hours.
Prerequisite: Consent of instructor. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Problems courses may be repeated for credit when the topics vary, but not more than 6 hours, regardless of discipline, will apply to a Master’s degree. Field trips may be required. (Formerly EES 6973).

ES 6981. Master’s Thesis. (0-0) 1 Credit Hour.
Prerequisite: Approval of the appropriate Graduate Program Committee to take the Comprehensive Examination. Independent study course for the purpose of taking the Comprehensive Examination. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to the Master’s degree. Credit will be awarded upon completion of the thesis. Enrollment is required each term in which the thesis is in progress.

ES 6983. Master’s Thesis. (0-0) 3 Credit Hours.
Prerequisites: Permission of the Graduate Advisor of Record and thesis director. Thesis research preparation. May be repeated for credit, but not more than 6 hours will apply to the Master’s degree. Credit will be awarded upon completion of the thesis. Enrollment is required each term in which the thesis is in progress. (Formerly EES 6983.).

ES 7211. Doctoral Research. (0-0) 1 Credit Hour.
Prerequisite: Admission to candidacy for the Doctoral degree. May be repeated for credit, but no more than 15 hours may be applied to the Doctoral degree. (Formerly EES 7211-3).

ES 7212. Doctoral Research. (0-0) 2 Credit Hours.
Prerequisite: Admission to candidacy for the Doctoral degree. May be repeated for credit, but no more than 15 hours may be applied to the Doctoral degree. (Formerly EES 7211-3).

ES 7213. Doctoral Research. (0-0) 3 Credit Hours.
Prerequisite: Admission to candidacy for the Doctoral degree. May be repeated for credit, but no more than 15 hours may be applied to the Doctoral degree. (Formerly EES 7211-3).
ES 7311. Doctoral Dissertation. (0-0) 1 Credit Hour.
Prerequisite: Admission to candidacy for the Doctoral degree. May be repeated for credit, but no more than 15 hours may be applied to the Doctoral degree. (Formerly EES 7311-3).

ES 7312. Doctoral Dissertation. (0-0) 2 Credit Hours.
Prerequisite: Admission to candidacy for the Doctoral degree. May be repeated for credit, but no more than 15 hours may be applied to the Doctoral degree. (Formerly EES 7311-3).

ES 7313. Doctoral Dissertation. (0-0) 3 Credit Hours.
Prerequisite: Admission to candidacy for the Doctoral degree. May be repeated for credit, but no more than 15 hours may be applied to the Doctoral degree. (Formerly EES 7311-3).