ENST - ENVIRONMENTAL SCIENCE AND TECHNOLOGY

ENST100 International Crop Production-Issues and Challenges in the 21st Century (3 Credits)
Examines the role of crop production in elevating humans out of poverty in developing countries. It will introduce students to the basic principles of plant and soil science underlying the international production of food crops and world food security. The role of multinational agencies such as the World Bank in the promotion of sustainable crop production using environmentally-sound technologies will also be discussed.
Credit Only Granted for: ENST100 or NRSC100.
Formerly: NRSC100.

ENST140 Sustainability and History: The Maryland Experience (3 Credits)
Examines the changing nature of concern over sustainability through the environmental history of the state of Maryland. The historical approach, supplemented by discussion of the basic scientific processes underlying ecosystem functions and human impacts on the environment, reveals both enduring and changing qualities of the search for sustainable patterns of living, beginning before 17th century European contact and continuing on into the environmental concerns of our own time.

ENST200 Fundamentals of Soil Science (4 Credits)
Study and management of soils as natural bodies, media for plant growth, and ecosystem components. Morphology, composition, formation, and conservation of soils. Chemical, biological, and physical properties are discussed in relation to the production of plants, the functioning of hydrologic and nutrient cycles, the protection of environmental quality, and engineering uses of soils.
Corequisite: CHEM131 and CHEM132; or permission of AGNR-Environmental Science & Technology department.
Credit Only Granted for: ENST200 or NRSC200.
Formerly: NRSC200.

ENST214 Introduction to Fish and Wildlife Sciences (3 Credits)
Lectures, discussion, and readings in social, biological, and human dimension issues facing fisheries and wildlife biologists and natural resource managers in the United States. Coverage will include history and philosophical discussions of fish and wildlife sciences; conservation and management; principles of community, habitat, and animal ecology and management; and interrelations of wildlife, fish, and forestry.
Prerequisite: BSCI160 and BSCI161; or permission of instructor.
Restriction: Must be in the ENST Natural Resources Management or ENSP Wildlife Ecology & Management programs; and must have completed less than 90 credits; or permission of instructor.

ENST233 Introduction to Environmental Health (4 Credits)
Examines how humans are affected by the quality of our air, water, soil and food supply as well as how human activities alter these survival necessities. Students will learn how the evolution and prosperity of human populations have resulted in degradation of our environment and the impact of environmental degradation on the health of people. The implications of individual and collective choices for sustainable food production, population management, and resource utilization will be explored.

ENST281 Computer Aided Design in Ecology (2 Credits)
Basics of Computer Aided Drawing (CAD) applied to design of constructed ecosystems. Use of campus stormwater wetland as case study.
Restriction: Must be in Environmental Sci & Tech program.

ENST282 Ecological Innovation and Entrepreneurship (3 Credits)
Ecotechnology innovation is taught with design thinking, which uses an iterative cycle of developing customer empathy, learning ecological technology, appreciating environmental stewardship, brainstorming, rapid prototyping, user experience, testing and redesign. Environment entrepreneurship is based on the Lean Startup process, which uses customer discovery, encourages quick product development, reduces start-up costs, tests ideas quickly, and employs designed experiments. A multidisciplinary academic setting embraces designing, building, testing and marketing novel technologies that enhance the environmental needs of humans. Students will learn in an active environment that requires working creatively, collaboratively, diligently, and precisely to create a business model and tangible prototype for a new commercial product.
Credit Only Granted for: ENST282 or ENST499K.
Formerly: ENST499K.

ENST301 Field Soil Morphology I (1 Credit)
This is a field-oriented course that introduces students to the techniques used to (1) describe soil morphology, and site and profile characteristics, (2) make land use interpretations based on soil characteristics, and (3) classify soils. This class is designed to prepare students for the Regional Collegiate Soil Judging Contest and for students to gain experience in the description and interpretation of soils in the field.
Restriction: Permission of AGNR-Environmental Science & Technology department.
Formerly: ENST308.

ENST302 Field Soil Morphology II (1 Credit)
This is the second field-oriented course in a three course sequence that provides intermediate training for students in the techniques used to (1) describe soil morphology, and site and profile characteristics, (2) make land use interpretations based on soil characteristics, and (3) classify soils. This class is designed to prepare students for the Regional Collegiate Soil Judging Contest and for students to gain experience in the description and interpretation of soils in the field.
Prerequisite: ENST301.
Restriction: Permission of AGNR-Environmental Science & Technology department.
Formerly: ENST308.

ENST303 Field Soil Morphology III (1 Credit)
This is the third field-oriented course in a three course sequence that provides intermediate training for students in the techniques used to (1) describe soil morphology, and site and profile characteristics, (2) make land use interpretations based on soil characteristics, and (3) classify soils. This class is designed to prepare students for the Regional Collegiate Soil Judging Contest and for students to gain experience in the description and interpretation of soils in the field.
Prerequisite: ENST302.
Restriction: Permission of AGNR-Environmental Science & Technology department.
Formerly: ENST308.

ENST309 Advanced Field Soil Morphology (1 Credit)
This is a field-oriented course that provides advanced training for students in the techniques used to (1) describe soil morphology, and site and profile characteristics, (2) make land use interpretations based on soil characteristics, and (3) classify soils. This class is designed to prepare students for the National Collegiate Soil Judging Contest and for students to gain experience in the description and interpretation of soils in the field. Students will be exposed to a variety of soil landscapes and geology from outside of the northeastern U.S.
Prerequisite: ENST301.
Restriction: Permission of AGNR-Environmental Science & Technology department.
Repeatable to: 3 credits if content differs.

ENST314 Fisheries Management and Sustainability (3 Credits)
A detailed look at the ecology, management, and sustainability of fisheries resources. Concepts on human and ecological dimensions are emphasized.
Prerequisite: BSCI160 and BSCI161; or BSCI106. Or ENST214; and 1 course from MATH113-499 course range. Or permission of AGNR-Environmental Science & Technology department.

ENST333 Ecosystem Health and Protection (3 Credits)
Discussion of the philosophies, principles, and practices for assessing ecosystem health with emphasis on an ecosystem perspective rather than a human health perspective. Degradation associated with human activities will be emphasized. Topics will range from local to regional to global issues, including a discussion on global warming and its possible impacts on ecosystems. Concepts will be clarified using case histories from the Chesapeake Bay watershed.
Prerequisite: ENST233.
Restriction: Must be in one of the following programs (Environmental Sci & Tech: Ecological Tech Design; Environmental Sci & Tech: Environmental Health; Environmental Sci & Tech: Soil & Watershed Science; Environmental Sci & Tech: Natural Resources Mgmt; Environmental Sci & Tech).
Credit Only Granted for: ENST499A or ENST333.
Formerly: ENST499A.

ENST334 Environmental Toxicology (3 Credits)
Concepts and case histories in ecotoxicology. Emphasis on origin and variety of environmental pollutants, routes of biological exposure, modes of toxicological action and effects on individual organisms, populations and ecosystems. Ecotoxicological issues in the Chesapeake Bay will be used as examples.
Prerequisite: CHEM131, CHEM132, and BSCI207; or permission of AGNR-Environmental Science & Technology department.

ENST360 Ecosystem Ecology (4 Credits)
The study of ecology has a long and interesting history, from early society's efforts to understand and alter their environment as a matter of survival to the challenges the modern world is facing that are global in scale. Through the course text, distributed supplemental chapter readings and an understanding of the scientific literature, this course will cover the essential concepts and principles of ecosystem ecology as well as its history and past and present controversies. Several of the basic methods and tools of field research and the applied management of ecosystems will be discussed and demonstrated with several field excursions in the natural environs of the DC area. Central to this course will be the understanding that modern human society is an integral part of nature, with the power to impact and influence elements of the natural world at multiple scales. An analysis of policy implications for the biosphere will be discussed.
Prerequisite: BSCI160 and BSCI161; or BSCI106.
Restriction: Must be in one of the following programs (Environmental Sci & Tech: Ecological Tech Design; Environmental Sci & Tech: Environmental Health; Environmental Sci & Tech: Soil & Watershed Science; Environmental Sci & Tech: Natural Resources Mgmt; Environmental Sci & Tech).

ENST373 Natural History of the Chesapeake Bay (3 Credits)
Consideration of the major groups of organisms associated with the Chesapeake Bay and current issues that determine humans' present and future uses for the Chesapeake and its biota.Cross-listed with BSCI373.
Credit Only Granted for: BSCI373 or ENST373.

ENST388 Honors Thesis Research (3-6 Credits)
Undergraduate honors thesis research conducted under the direction of an AGNR faculty member in partial fulfillment of the requirements of the College of AGNR Honors Program. The thesis will be defended to a faculty committee.
Restriction: Permission of AGNR-Environmental Science & Technology department.
Repeatable to: 6 credits if content differs.

ENST389 Internship (3 Credits)
Credit will be granted for practical work carried out by students placed in work environment related to their stated career goals. Students must do an in-depth study in some portion of the work experience and produce a special project or report related to this study. A student work log is also recommended. An evaluation from the external supervisor of the project will be required. Credit arranged with supervising faculty member.
Restriction: Must be in Environmental Sci & Tech program.
Repeatable to: 6 credits if content differs.

ENST403 Invasive Species Ecology (3 Credits)
We will examine ecological, evolutionary, and anthropogenic processes facilitating or resisting biological invasions, and consider their environmental, economic, and human health impacts. We will consider various management strategies to mitigate invasions and identify areas of future research. Field trips and detailed discussion of recent findings and controversies in the literature will help illustrate fundamental concepts of invasions among various ecosystems.
Credit Only Granted for: ENST403, ENST603, or ENST689R.

ENST404 Ecological and Natural Resources Ethics (3 Credits)
Bridges science and management with ethical theory and concepts to help scientists, regulators, and managers understand how to deal with potential ethical dilemmas that arise in natural resource and environmental management implementation and policy development.
Prerequisite: ENST214 and ENST360.
Recommended: ENST314, ENST410, and ENST460.
Restriction: Senior standing or higher. Jointly offered with ENST604.
Credit Only Granted for: ENST604 or ENST404.

ENST405 Energy and Environment (3 Credits)
Introduction to the role of energy in environmental and human-dominated systems. Discussion of the historical and modern production and consumption of energy. Introduction to energy systems computer simulation and energy auditing.
Prerequisite: MATH140 or MATH120; or must have completed MATH220.
Restriction: Junior standing or higher. And must be in Environmental Sci & Tech program; or must be in Environmental Sci & Tech: Ecological Tech Design program; or must be in Environmental Sci & Tech: Environmental Health program; or must be in Environmental Sci & Tech: Soil & Watershed Science program; or must be in Environmental Sci & Tech: Natural Resources Mgmt program. Jointly offered with ENST605.
Credit Only Granted for: ENST405, ENSP350, ENST605, or MEES698Z.

ENST406 Applied Forestry Practices (3 Credits)
Focuses on the applied dynamics of a set of forest practices such as management, silviculture, measurement and inventory, preparation of a management plan, etc, within the urban/rural interface. Several field trips are included to gain hands-on experience.
Prerequisite: ENST200. And ENST360; or PLSC471. Cross-listed with PLSC4 75.
Credit Only Granted for: ENST406 or PLSC475.

ENST410 Ecosystem Services: An Integrated Analysis (3 Credits)
The importance of our ecosystems and the services they provide will be discussed. Basic principles used to analyze ecosystem services will be discussed and applied using case studies & field exercises. Forestland, wetlands and our marine resources are increasingly recognized for their ecosystem services provided to society, to include clean air and water, wildlife habitat, biodiversity, carbon storage and pollination services. This course will prepare students to deal with the complex issues involved in understanding those and other ecosystem services and their importance to society and environmental sustainability. Slowly, new markets are emerging for these services. Students will analyze the ecological, policy and financial dimensions of enhancing, restoring, and sustaining ecosystem services. New and on-going government programs and private business ventures will be discussed.
Prerequisite: ENST360 or BSCI361; or permission of instructor.
Restriction: Must be in one of the following programs (Environmental Sci & Tech: Ecological Tech Design; Environmental Sci & Tech; Environmental Sci & Tech: Natural Resources Mgmt; Environmental Sci & Tech: Soil & Watershed Science; Environmental Sci & Tech: Environmental Health).

ENST411 Principles of Soil Fertility (3 Credits)
Soil factors affecting plant growth and quality with emphasis on the bio-availability of mineral nutrients. The management of soil systems to enhance plant growth by means of crop rotations, microbial activities, and use of organic and inorganic amendments.
Prerequisite: ENST200; or students who have taken courses with comparable content may contact the department. Jointly offered with ENS T611.
Credit Only Granted for: ENST411 or NRSC411.
Formerly: NRS C411.

ENST414 Soil Morphology, Genesis and Classification (4 Credits)
Processes and factors of soil genesis. Taxonomy of soils of the world by U.S. System. Soil morphological characteristics, composition, classification, survey and field trips to examine and describe soils.
Prerequisite: ENST200.
Credit Only Granted for: ENST414 or NRSC414.
Formerly: NRSC414.

ENST415 Renewable Energy (3 Credits)
An overview of renewable energy technologies and their current applications. Emphasis will be placed on technological readiness, efficiency and sustainability of renewable energy alternatives. Technologies include solar thermal, photovoltaics, biodiesel, ethanol, anaerobic digestion, wind, hydroelectric, and microbial fuel cells.
Prerequisite: CHEM131, PHYS121, and MATH113; or permission of AGNR-Environmental Science & Technology department.
Restriction: Must be in a major within AGNR-Environmental Science & Technology department.

ENST417 Soil Physics and Hydrology (3 Credits)
A study of soil water interactions: the hydrologic cycle; the unique properties of water and soil; the soil components and their interactions; the field water cycle; transport processes involving water, heat and solutes; human effects on soil and groundwater; as well as the measurement, prediction, and control of the physical processes taking place in and through the soil.
Prerequisite: ENST200; and (MATH113 or MATH115). Or permission of instructor.
Credit Only Granted for: ENST417 or NRSC417.
Formerly: NRSC417.

ENST421 Soil Chemistry (4 Credits)
The chemistry and composition of mineral and organic colloids in soils, including ion exchange, oxidation-reduction, acidity, surface charge, and solution chemistry. Lectures and readings pertain to plant nutrition, waste disposal, and groundwater quality.
Prerequisite: ENST200.
Credit Only Granted for: ENST421 or NRSC421.
Formerly: NRSC421.

ENST422 Soil Microbial Ecology (3 Credits)
The interdisciplinary study of soil microorganisms and their interactions with the mineral matrix; resulting in processes such as nutrient cycling, decontamination, and natural product production. We will focus on the diversity of soil communities, their survival strategies, and the new strategies used to study these communities.
Prerequisite: ENST200; or 1 course in BCHM; or must have completed a course in microbiology; or students who have taken courses with comparable content may contact the department. Jointly offered with ENS T622.
Credit Only Granted for: ENST422 or NRSC422.
Formerly: NRS C422.

ENST423 Soil-Water Pollution (3 Credits)
Reaction and fate of pesticides, agricultural fertilizers, industrial and animal wastes in soil and water with emphasis on their relation to the environment.
Prerequisite: CHEM104 and ENST200.
Credit Only Granted for: ENST423 or NRSC423.

ENST424 Field Study in Soil Morphology (4 Credits)
The fundamentals of making morphological descriptions of soils, using standard techniques, terminology, and abbreviations of the National Cooperative Soil Survey. Given a regional perspective and reasonable assumptions regarding soil properties, students should become competent to classify soils which they have described in the field and also make interpretations concerning the suitability of soils for various potential uses.
Prerequisite: ENST200.
Credit Only Granted for: ENST424 or NRSC424.
Formerly: NRSC424.
Additional Information: Students must pay a $300 course activities fee.

ENST430 Wetland Soils (3 Credits)
The soils of wetlands including hydrology, chemistry, and genesis are discussed. Federal and regional guidelines for wetland soils are covered with an emphasis on validating interpretations through field observations.
Prerequisite: ENST200.
Credit Only Granted for: ENST430, ENST630, or NRSC461.
Formerly: NRSC461.

ENST432 Environmental Microbiology (3 Credits)
Microorganisms are everywhere and mediate many of the processes that we observe everyday. These organisms are the unseen catalysts for numerous industrial processes and are critical to many emerging technologies and novel products. Environmental microbiologists ask: How do microorganisms in the environment benefit society? This course will answer this question by examining microbes in bioremediation, food safety, climate change, and biotechnology.
Prerequisite: CHEM131 and CHEM132. And BSCI170 and BSCI171; or BSCI105.
Credit Only Granted for: ENST432 or ENST499M.
Formerly: ENST499M.

ENST434 Toxic Contaminants: Sources, Fate, and Effects (3 Credits)
Study of the release to the environment, transport through natural compartments, persistence and ultimate fate of various classes of contaminants produced as a result of human activities. Topics will culminate in discussions of impacts to wildlife and human health. Students should emerge with a practical appreciation of the actual risks from exposure to a variety of environmental contaminants and an understanding of the environmental and human health implications of continuing the contaminating activities.
Prerequisite: ENST333 and ENST334.

ENST436 Emerging Environmental Threats (3 Credits)
Examine new and potential environmental concerns in the air, water, soil, space, and the built environment. Emphasis on studying the intrinsic links between ecosystem and human health. Topics will include climate change, resource consumption, biodiversity change, infectious disease, non-traditional pollutants, and other complex and significant environmental concerns.
Prerequisite: ENST233; or permission of AGNR-Environmental Science & Technology department.

ENST440 Crops, Soils and Civilization (3 Credits)
Role and importance of crop and soil resources in the development of human civilization. History of crop and soil use and management as they relate to the persistence of ancient and modern cultures.
Credit Only Granted for: ENST440 or NRSC440.
Formerly: NRSC440.

ENST441 Sustainable Agriculture (3 Credits)
Environmental, social and economic needs for alternatives to the conventional, high-input farming systems which currently predominate in industrial countries. Strategies and practices that minimize the use of non-renewable resources.
Credit Only Granted for: ENST441 or NRSC441.
Formerly: NRSC441.

ENST443 Industrial Ecology (3 Credits)
Problems of waste management and recycling in human societies are covered. The industrial ecology approach to design is contrasted with analogous patterns and processes from natural ecosystems.
Prerequisite: (MATH140 or MATH120; or must have completed MATH220); and BSCI361. Or permission of AGNR-Environmental Science & Technology department. Jointly offered with ENST643.
Credit Only Granted for: ENST443, ENST643, or MEES698J.

ENST445 Ecological Risk Assessment (3 Credits)
Assessment of ecological impacts of perturbations on natural systems. Course will describe methods for estimating environmental impacts including extrapolating from laboratory and field data. The role of regulatory agencies and implications of scientific uncertainty on risk management will be covered.
Prerequisite: ENST360 or BSCI361; and (BIOM301 and ENST334). Or permission of AGNR-Environmental Science & Technology department.

ENST450 Wetland Ecology (3 Credits)
Plant and animal communities, biogeochemistry, and ecosystem properties of wetlands. Lectures are supplemented by weekend or Friday field trips (1-3 days total during the semester) and in-class labs that emphasize collection and analysis of field data on wetland vegetation, soil, and hydrology. Wading boots (at least hip length) are strongly recommended.
Prerequisite: BIOM301; or permission of AGNR-Environmental Science & Technology department. Jointly offered with ENST650. Credit only grant ed for: ENST450 or MEES650.

ENST452 Wetland Restoration (3 Credits)
Design, construction, and evaluation of wetlands restored or created to provide ecosystem services or to mitigate losses due to development. Topics include fundamental properties of wetlands, ecological restoration theory, site selection and goal-setting, design plans, practices for establishing wetland hydrology, substrate, and vegetation, and restored ecosystem monitoring.
Prerequisite: (BSCI160 and BSCI161; or BSCI106); and (BSCI362, ENST450, ENST360, or BSCI361).

ENST453 Watershed Science: Water Balance, Open Channel Flow, and Near Surface Hydrology (3 Credits)
Concepts of surface water balance, surface radiative flux, precipitation and evaporation measurements.
Credit Only Granted for: ENST453 or ENST653.

ENST456 Spatial Analysis and Ecological Sampling (3 Credits)
Teaches ENST students ecological sampling methods and applied spatial analysis skills. Students will work in small groups on research projects they develop and test during the semester. Students will develop a research hypothesis, test their hypothesis, display it visually in QGIS, and analyze it with appropriate statistical methods in QGIS and R Studio culminating in a final presentation.
Recommended: GEOG306 and GEOG373.
Restriction: Senior standing or higher; and permission of instructor.
Credit Only Granted for: ENST456 or ENST499T.
Formerly: ENST499T.
Additional Information: Students will need to provide an 8GB (or larger) thumb drive for data storage.

ENST460 Principles of Wildlife Management (3 Credits)
Ecological principles and requirements of wildlife as basis for management, and introduction to the scientific literature. Conflicts in wildlife management, government administration of wildlife resources, legislation, and history of the wildlife management profession.
Prerequisite: Must have completed two semesters of biology laboratory; and (ENST360; or BSCI361). Or permission of AGNR-Environmental Science & Technology department.

ENST461 Urban Wildlife Management (3 Credits)
Ecology and management of wildlife in urban areas. For students in biological sciences, geography, landscape design, natural resources management, recreation and urban studies. Planning, design, and wildlife conservation in landscape ecology. Public attitudes, preferences, and values, review of private conservation organizations.

ENST462 Field Techniques in Wildlife Management (3 Credits)
Hands-on experience with field techniques in wildlife management focusing on various methods of conducting indices, estimates, and censuses of wildlife populations. Includes capture and handling of amphibians, reptiles, birds, and mammals by use of drift fences, cover boards, mist nets, box traps, and dart guns.
Prerequisite: ENST460. And BSCI160 and BSCI161; or BSCI106. And BSCI170 and BSCI171; or BSCI105.
Recommended: ENST461.
Restriction: Permission of AGNR-College of Agriculture & Natural Resources.

ENST463 Wildlife Habitat and Population Modeling (3 Credits)
Students will gain basic tools for the analysis and modeling of wildlife population demographics and wildlife habitat. This class will be broken into two components: 1) will teach students techniques of modeling wildlife field data for the purpose of estimation of key parameters such as population size, viability, and other demographic rates using programs such as Riskman, Vortex, and Mark; 2) will teach students real world techniques used to determine and model habitat use on multiple scales using statistical analyses, GIS, and stand-alone programs such as Home Ranger and Biomapper. This class is designed for wildlife and natural resources majors.
Prerequisite: ENST460 and GEOG373; and (MATH120; or must have completed MATH220). Or permission of AGNR-Environmental Science & Technology department.
Restriction: Must be in Environmental Sci & Tech program; and must be in Environmental Science and Policy program.

ENST466 Ecology and Management of Wildlife Habitats (3 Credits)
Introduction to general concepts of wildlife habitat ecology and management. Specifically,land use practices on public and private lands and how these practices influence wildlife production. Conduct wildlife habitat evaluations and options for alterations/manipulations to achieve specific management goals. The class will culminate with the creation and planning of a wildlife management plan.
Recommended: ENST460.

ENST467 Ecology and Management of Wildlife Habitats Lab (2 Credits)
An introduction to the principles of wildlife habitat data analysis applied at the population level. This class will teach students real world techniques used to determine and model habitat use on multiple scales. This lab course complements the material covered in ENST 466.
Corequisite: ENST466.

ENST470 Ideas into Impact (3 Credits)
This will be a capstone-type course based around developing proposals for projects emphasizing research, monitoring, design, restoration, managament, entrepreneurship, or other approaches to ecological or environmental questions, issues, or problems.
Restriction: Junior or Senior standing only; Permission of AGNR-Environmental Science & Technology department.

ENST471 Captsone I (2 Credits)
This course will be conducted in a group discussion format that will focus on professional project proposal preparation and presentation, critical evaluation of environmental science research, professional development, and career planning. Students will develop and present original project proposals and critique project proposals presented by others.

ENST472 Capstone (3 Credits)
This capstone course focuses on professional project preparation, presentation, and critical evaluation on environmental science research. Students will develop and present original projects and critique projects presented by others.
Restriction: Must be in a major within AGNR-Environmental Science & Technology department; and permission of AGNR-Environmental Science & Technology department.
Additional Information: This is the pinnacle course for students majoring in ENST and is therefore recommended in one of the students' final semesters.

ENST479 Tropical Ecology and Resource Management (1-6 Credits)
Tropical ecosystems and issues of human use and impact. Includes lectures which lead up to an off-campus trip in a tropical environment.
Prerequisite: Must have completed an introductory economics course. And BSCI160 and BSCI161; or BSCI106.
Restriction: Permission of instructor.
Repeatable to: 10 credits if content differs.

ENST481 Ecological Design (4 Credits)
An advanced survey course on the field of ecological design. Principles of design are illustrated with case studies from biologically-based waste treatment systems, ecosystem management and sustainable development. Concepts covered include ecology, ecological engineering, nutrient cycling, emergy, lifecycle analysis, and design process. Technologies include treatment wetlands, living machines, anaerobic digestion, rain gardens, bioswales, bioremediation, algal turf scrubbers, and green building design.
Prerequisite: (MATH120 or MATH140; or must have completed MATH220); and (PHYS121 and CHEM131); and (BSCI361; or students who have taken courses with comparable content may contact the department). Or permission of instructor.
Restriction: Permission of AGNR-Environmental Science & Technology department. Jointly offered with MEES681. Credit only grant ed for: ENST481, ENST681, or MEES681.

ENST485 Water Management in Urban Environment (3 Credits)
Historically, with the exception of certain locations, water has been available in sufficient quantities, and providing supporting infrastructure has been relatively straightforward. In urban areas, the concentration of people and the drastic changes in land use, have altered the fluxes of water, sediments, chemicals, and microorganisms. As the population increases and the number of large urban areas keeps growing (both in U.S. and internationally), managing water in urban areas is becoming more challenging. Water must be supplied for domestic, commercial, and industrial use, as well as irrigation and maintaining and enhancing local environments (e.g., urban streams). In addition, stormwater must be managed to prevent flooding and environmental damage, and used water, which contains organic matter, nutrients, and other constituents that can be extracted and reused, must be collected and managed. In this course we take a systems approach to urban water hydrology, engineering, planning and management. We will explore urban water cycle, urban runoff and drainage characteristics, urban water supply and demand, stormwater collection and treatment and designing best management practices. Additionally, we look at the climate impacts on the urban water cycle.
Prerequisite: MATH120, MATH130, MATH136, or MATH140.
Credit Only Granted for: ENST485 OR ENST489Z.
Formerly: ENST489Z.

ENST486 Senior Professional Internship (3 Credits)
Students will arrange an off-campus internship experience related to Environmental Science and Technology to develop expertise in a specific area of their ENST concentration curriculum. Classroom sessions will frame student experiences within the broader discipline of Environmental Science and Technology.
Prerequisite: ENST389.
Restriction: Must be in the Environmental Science and Technology program; and permission of AGNR-Environmental Science & Technology department.
Additional Information: The course has two types of activities: lecture and experiential learning. Students are supposed to work on their internship for 90 hours and participate in a 2-hour lecture every other week, during the semester.

ENST487 Environmental Conflicts and Decision Making (2 Credits)
Study major cases which focus on environmental science with concentration on the role and techniques of negotiation, collaborative decision making, and adaptive resource management as an environmental conflict resolution process.
Restriction: Senior standing. And must be in one of the following programs (Environmental Sci & Tech: Natural Resources Mgmt; Environmental Sci&Pol-Wildlife Ecology & Mgmt) ; or permission of AGNR-Environmental Science & Technology department.

ENST489 Research Experience (3 Credits)
An advanced research-based course in the field of environmental science and technology.
Restriction: Permission of AGNR-Environmental Science & Technology department.
Repeatable to: 6 credits.

ENST499 Special Topics in Environmental Science and Technology (1-4 Credits)
An independent study, and/or lecture, and/or laboratory series organized to study a selected phase of Environmental Science and Technology not covered by existing courses. Credit arranged with supervising faculty member.
Restriction: Permission of AGNR-Environmental Science & Technology department.