EN.575 (ENVIRONMENTAL PLANNING AND MANAGEMENT)

Courses

EN.575.608. Optimization Methods for Public Decision Making. 3 Credits.
This course is an introduction to decision support models used in environmental planning and management. We will develop and apply analytical methods and mathematical models that help decision makers solve complex environmental and socio-economic problems and formulate associated policies. There is a focus on real-world problems in the public sector, including urban facility location, transportation planning, water resources management, biological conservation, and landscape resources management. You will learn how to structure and analyze problems and formulate optimization models to make the most of limited resources and achieve specified objectives related to efficiency, cost-effectiveness, environmental protection, public health, and fairness to stakeholder groups and to the public. The types of models covered in this course are linear programming, integer programming, and multi-objective models. Algorithmic solution methods are reviewed, and computer-based solution methods are applied in the context of a course project. Prerequisite: pre-calculus mathematics including algebra with multiple variables.

EN.575.611. Economic Foundations for Public Decision Making. 3 Credits.
The course examines intermediate-level price theory and surveys applications to public-sector decision making. Topics include demand, supply, behavior of the market, and introductory welfare economics. Applications include forecasting, cost-benefit analysis, engineering economics, and public sector pricing.

EN.575.628. Business Law For Engineers. 3 Credits.
This course introduces engineers to the basic legal principles they will encounter throughout their careers. Course discussions cover contracts (formation, performance, breach, and termination), corporations and partnerships, insurance, professional liability, risk management, environmental law, torts, property law, and evidence and dispute resolution. The course emphasizes those principles necessary to provide engineers with the ability to recognize issues that are likely to arise in the engineering profession and introduces them to the complexities and vagaries of the legal profession. This course also affords a proper foundation for students interested in law-related ancillary careers such as forensic consulting.

EN.575.635. Environmental Law for Engineers & Scientists. 3 Credits.
This course explores fundamental legal concepts relevant to environmental issues, including the relationship between statutes, regulations, and court decisions. Also included are various forms of enforcement used in environmental rules: command and control, liability, and information disclosure. Specific issues include criminal enforcement, a survey of environmental statutes, regulations and case law, the purpose and misconceptions surrounding environmental audits and assessments, the concept of attorney-client privilege, unauthorized practice of law, and ethical conflicts between the attorney and engineer/scientist roles.

EN.575.637. Environmental Impact Assessment. 3 Credits.
This course provides a thorough review and application of the Environmental Impact Assessment (EIA) process and the National Environmental Policy Act (NEPA.) It covers selection of scientific, engineering, and socioeconomic factors in EIA; identification of quantitative and qualitative environmental evaluation criteria; EIA life cycle application of techniques for assessing impacts of predicted changes in environmental quality; approaches for identifying, measuring, predicting, and mitigating environmental impacts; modeling techniques as employed in EIA; environmental standards in the EIA process; sustainable development goals (SDG) as applied to EIA, methodologies for incorporating EIA into management decision-making. EIA alignment with climate change and Diversity, Equity, and Inclusion (DEI) as related to EIA are addressed. Case studies of EIA for several types of engineering projects are employed. Students acquire the knowledge to prepare an EIA, critically review and analyze an EIA, apply EIA as an important tool in management decision-making processes and develop a comprehensive analytical example of an Environmental Impact Statement (EIS).

EN.575.640. Geospatial Intelligence: the art and science for better understanding our world. 3 Credits.
Through lectures and laboratory exercises, this course illustrates the fundamental concepts of GIS and remote sensing technologies in the context of environmental engineering. Topics include the physical basis for remote sensing, remote sensing systems, digital image processing, data structures, database design, and spatial data analysis. The course is not intended to provide students with extensive training in particular image processing or GIS packages. However, handson computer laboratory sessions re-enforce critical concepts. Completion of a term project is required.

EN.575.707. Environmental Compliance Management. 3 Credits.
The course covers compliance with environmental laws and regulations by industry, small business, government facilities, and others. It includes legal responsibilities, environmental management systems, and practices such as audits and information systems and development of corporate policies and procedures that rise to the daunting challenge to harmonize the institution's primary goals with its environmental obligations. Several dimensions of environmental management are discussed: federal, state, and local regulation; scientific/technical factors; public relations and the press; and institutional objectives including economic competitiveness.

EN.575.710. Financing Environmental Projects. 3 Credits.
This course treats the financing of projects from two complementary perspectives: that of a government agency funding source, and that of an environmental utility (water, wastewater, solid waste) that needs funds for its project. It discusses grants, concessionary loans, market loans, and loan guaranties, along with their relative desirability and efficiency. Since grant funding is never available for all projects, the course deals extensively with borrowing/lending. It discusses strategies for maximizing utility income, including appropriate tariff structures and the reform of government subsidy policy from supply-based general subsidies to demand-based targeted subsidies. Operational strategies to maximize income are also discussed, such as techniques to improve billing and collections, reduce losses, and reduce energy costs. Traditional cash flow analyses are used to determine debt service capabilities. Various project cost reduction strategies, such as staging and scaling, are introduced. Grants in the form of upfront project cost buy-downs vs. annual debt service subsidies are compared. Finally, several examples of project financing combining many of the elements introduced during the course are presented and analyzed. Advocacy skills for financing environmental projects and obtaining funding sources are major areas of focus.

EN.575.714. Water Resources Management. 3 Credits.
This course examines the technical, economic, and social aspects of managing water resources. A review of water fundamentals involving physical, chemical, and biological systems provides a foundation. Students are given a historical basis for thinking about and resolving contemporary challenges. Observed and predicted climate change impacts on water resources are explored along with management implications and responses. Key water law concepts, their roots in social institutions, and current traditional institutions are covered. The course surveys regulatory instruments, like permits, and their operation across federal, state, and local levels of government. Funding and financing issues are covered. The course addresses the management of water supply and demand in the United States. Fundamentals of flood and drought management are covered, with attention given to climate change. Water quality-based management under the federal Clean Water Act includes the topics of water quality standards, water quality assessments, total maximum daily loads (TMDLs), and implications for permit requirements. Regional ecological water resources management is addressed by contrasting the Chesapeake Bay case with other cases. The topic of natural environmental flows explores the benefits of natural flow variability and the interrelationships among five key functions that characterize the health of a stream and support stream restoration design. Water resource management decision making is addressed in terms of structured techniques involving economic analyses, multi-objective analyses, and collaborative decision making with a focus on the role of public involvement. Students will be led in the development of a well-defined, substantive water resources management research question as part of a course project.

EN.575.731. Water Resources Planning. 3 Credits.
The course will discuss the application and interrelationships among microeconomics, ecology, hydrology, and fields related to the planning and management of water systems. Topics will include flood control, navigation, hydroelectric power, water supply, environmental restoration, multi-objective planning, and urban water resource management. The course will demonstrate the process for planning a water resource project, including identifying the problems and opportunities, inventorying and forecasting conditions, formulating alternative plans, evaluating alternative plans, comparing alternative plans, and selecting a plan. Particular attention will be paid to the appropriate interdisciplinary approach to plan formulation.

EN.575.737. Environmental Security with Applied Decision Analysis Tools. 3 Credits.
This multi-disciplinary course examines current and emerging environmental security issues at multinational, national, and regional scales. These issues are approached from the perspective of decision-making for policy, planning, and management. The course begins with an overview and definitions of environmental security within the context of present global demographic patterns, use of natural resources, and climate change. The theory and principles of multi-criteria decision analysis (MCDA) are reviewed, using environmental security examples to illustrate concepts. Three MCDA methodologies are presented, including multi-attribute weighting, Analytic Hierarchy Process, and outranking, which are commonly used to assist decision makers. The MCDA approach is critiqued from the perspective of measurement theory and guidelines for MCDA use are suggested. With both the social sciences and natural sciences providing a framework, several specific environmental security topics are covered in greater depth: energy; air quality; ecosystems and biodiversity; fresh water; agriculture and food; and sea level rise. Within these topics, students will develop MCDA models for particular policy, planning, and management problems under the guidance of the instructors. The course concludes by considering the prospects for environmental security and sustainability in the coming decades.

EN.575.747. Environmental Project Management. 3 Credits.
This course provides students with the knowledge for an integrated approach to environmental project management, applying pertinent scientific, engineering, legal, public policy, and project management disciplines. Emphasis is placed on factors that are common to an environmental project, such as external impacts, stakeholder conflicts, scope uncertainty, and the evolving environmental regulatory environment. The students learn the elements of environmental project plans, including project organization and staffing, schedule dependencies and optimization, cost estimating and control, and communication with internal and external stakeholders. The types of environmental projects addressed include infrastructure, restoration and remediation, program development, and alternatives analysis. Project Management Institute materials are utilized, along with case studies, to illustrate actual project conflicts, necessary adjustments, and successes.

EN.575.751. Environmental Justice, Climate, and Health Equity. 3 Credits.
Environmental planners are uniquely positioned to address climate change, environmental health, and health equity. The will course lectures and applied exercises will offer students a first-hand experience assessing the impact of environmental planning on climate and public health and the impact of environmental justice movements in the United States and globally. Students will harness evidence-based practices with community stakeholders to address emerging environmental and public health challenges. These applied exercises with community stakeholders will reinforce seminal course concepts.

EN.575.753. Communication of Environmental Information and Stakeholder Engagement. 3 Credits.
This course provides students with the skills for communicating scientific environmental data and sustainable engineering design to stakeholders, including scientists in different fields, policy decision makers, and the interested public. The course covers the importance of clear communication of complex scientific information for the development and acceptance of technologies, public policy, and communitybased environmental initiatives. The key stakeholders for environmental engineers, scientists, and managers are specified. Methods of engagement and designing key messages are defined for global, national, and local issues of student interest. Major types of communication media are covered, including written communication and graphics, online communications in short- and long-form new media, and interactive communications such as surveys and citizen science to involve stakeholders in the creation and analysis of big data and dispersed information. The emphasis of the course is from the point of view of an environmental professional (not a marketing professional) and developing an effective sciencebased communications portfolio to share complex scientific information with a broad range of interested parties.

EN.575.759. Environmental Policy Analysis. 3 Credits.
The course explores the process of analyzing environmental policies to ensure human health, that environmental needs are protected, and that the physical environment is preserved, protected, and restored, if necessary. Emphasis is placed on the need to evaluate and make decisions regarding environmental science, human health, sociopolitical, technological, legal, and economic considerations in a context of incomplete information and uncertain futures. Case studies and policies relating to various contemporary environmental issues, for example hazardous waste disposal, natural resource extraction and preservation of natural resources, are critiqued during the semester. The course will lead students through the various steps of the policy analysis process. Students are expected to evaluate policy alternatives, develop evaluation criteria, and apply qualitative and quantitative methods to determine consequences, trade-offs, and potential synergies relating to these environmental issues. Students will then use these skills to create and execute an individual research project that analyzes an environmental policy relating to a specific issue of interest to them, evaluating potential responses to environmental management problems through analyzing the impacts of each policy alternative.