

# ENVIRONMENTAL ENGINEERING SCIENCES

---

## **CWR 5125 Groundwater Flow I 3 Credits**

**Grading Scheme:** Letter Grade

Porous media flow. Darcy's law. Conservation of mass. Laplace equation. Flownets. Well hydraulics.

**Prerequisite:** Undergraduate coursework including Differential Equations, Dynamics, Hydrodynamics (Fluid Mechanics), and Hydraulics.

## **CWR 6116 Advanced Surface Hydrology 3 Credits**

**Grading Scheme:** Letter Grade

Physical and quantitative concepts and principles of hydrologic processes and their engineering applications. Reynolds Transport Theorem, the Continuity and Momentum Equations applied to phenomena and processes. Hydrologic analyses, including unit hydrograph theory, lumped flow routing, and distributed flow routing. Engineering concepts of hydrologic design, design storms and hydrologic chemistry.

**Prerequisite:** ENV3040C or equivalent numerical methods, STA 3032 or equivalent statistics, CWR3201 or equivalent hydrodynamics

## **CWR 6252 Environmental Biochemistry of Trace Metals 3 Credits**

**Grading Scheme:** Letter Grade

Environmental impact and fate of trace metals and metalloids as they cycle through geological and biological environmental compartments. Emphasizes anthropogenic activities of metals with growing environmental concerns, including arsenic, mercury, chromium, and lead.

**Prerequisite:** consent of instructor.

## **CWR 6308 Advanced Urban Stormwater Systems Design 3 Credits**

**Grading Scheme:** Letter Grade

Stormwater system design including: time of concentration, peak runoff rate, open-channel flow, gravity storm sewer, culvert, stormwater pumping, filtration systems, hydrograph generation, flood routing, site layout, site grading and permitting.

**Prerequisite:** Understanding of undergraduate-level fluid mechanics and applied hydraulics.

## **CWR 6537 Contaminant Subsurface Hydrology 3 Credits**

**Grading Scheme:** Letter Grade

Physical-chemical-biological concepts and modeling of retention and transport of water and solutes in unsaturated and saturated media. Applications of environmental aspects of soil and groundwater contamination.

**Prerequisite:** None.

## **EES 6007 Advanced Energy and Environment 3 Credits**

**Grading Scheme:** Letter Grade

Energy basis for a system of humanity and nature, including principles of systems ecology, ecological economics, and public policy.

## **EES 6051 Advanced Environmental Planning and Design 3 Credits**

**Grading Scheme:** Letter Grade

Sustainable communities and regions. Quantitative methods for evaluating environmental impacts and carrying capacity. Theories of spatial and temporal organization of systems of humanity and nature.

## **EES 6208 Principles of Water Chemistry I 3 Credits**

**Grading Scheme:** Letter Grade

Applying chemical principles to aqueous reactions. Emphasizes thermodynamics, kinetics, and aqueous equilibria including acid-base, solubility, complexation, precipitation, and redox.

**Prerequisite:** Undergraduate coursework in both chemistry and calculus.

## **EES 6225 Atmospheric Chemistry 3 Credits**

**Grading Scheme:** Letter Grade

Nature, sources, and sinks of fixed and variable constituents of atmosphere. Chemical changes occurring. Influences and properties of atmospheric components of natural and anthropogenic origin.

**Prerequisite:** Undergraduate coursework including foundations of air pollution.

## **EES 6307 Advanced Ecological Engineering 3 Credits**

**Grading Scheme:** Letter Grade

An advanced course in the fundamental principles of ecology and engineering methods that enables students to use their engineering training to design and quantitatively evaluate interface ecosystems and restoration of drastically altered lands to create symbiotic relationships between humans and the environment.

## **EES 6309 Wetland Design and Restoration 3 Credits**

**Grading Scheme:** Letter Grade

Applied and theoretical aspects of wetlands use for water quality management; natural and constructed treatment wetlands; engineering and ecology of wetland systems; design for sustainability and ancillary benefits. Theoretical and applied aspects of the restoration and management of wetland ecosystems.

**Prerequisite:** EES 6308C; SWS 5242 or WIS 6934

## **EES 6344 Coastal Policy Lab 3 Credits**

**Grading Scheme:** Letter Grade

Provides students hands-on experience working on applied engineering and policy challenges faced by real-world stakeholders. Lectures will be given that provide foundational knowledge about how science, engineering and policy interconnect around coastal resilience challenges and solutions. Students will work in small groups to develop engineering research and policy outcomes that can be deployed by clients in the marine and coastal environments.

## **EES 6345 Florida Marine and Coastal Law and Policy 3 Credits**

**Grading Scheme:** Letter Grade

Introduces students in the engineering, science, and policy disciplines to the complex legal and regulatory framework that governs Florida's coast and nearshore waters. Among the areas that will be addressed are the law and policy of estuarine and nearshore water quality, submerged lands management, coastal and marine habitat restoration, protected species, and coastal resiliency. The role of climate change and climate science in the policy process will be featured.

## **EES 6346 Engineering Nature-Based Coastal Solutions 3 Credits**

**Grading Scheme:** Letter Grade

Provides students with the intellectual background, conceptual framework, and introductory skills needed to develop and incorporate Nature-Based Solutions (NBS) to engineering problems on the coast. Students will learn about the scientific, economic, and engineering rationale for nature-based solutions, engage with the research in nature-based solutions in coastal ecosystems, and develop their understanding of the relationships between ecosystem services, coastal dynamics, and coastal ecology.

**EES 6932 Modeling the Fate of Air Pollutants 3 Credits****Grading Scheme:** Letter Grade

Provides the concept/skill that integrate atmospheric kinetic and thermodynamic data obtained from photochemical reactors into gas/aerosol models using a kinetic solver. This course provides flexibility in modeling topics that allow students to study emerging issues in atmospheric chemistry and to individualize topics based on their backgrounds/research.

**Prerequisite:** Undergraduate coursework including general chemistry and foundations of air pollution.

**EEN 5949 Practicum/Internship/Cooperative Work Experience 1-6 Credits, Max 6 Credits****Grading Scheme:** S/U

Practical cooperative engineering work under approved industrial and faculty supervision.

**EEN 6640 Entrepreneurship for Engineers 3 Credits****Grading Scheme:** Letter Grade

Introduction to entrepreneurship, idea generating and feasibility analysis, and business planning. Lectures, case studies, student-led discussions, team business plans, and investor presentations.

**EEN 6913 Engineering Graduate Research 0-3 Credits, Max 12 Credits****Grading Scheme:** S/U

Course will provide the student with supervised research in a laboratory setting.

**ENV 5105 Foundations of Air Pollution 3 Credits****Grading Scheme:** Letter Grade

Principal types, sources, dispersion, effects, and physical, economic and legal aspects of control of atmospheric pollutants.

**ENV 5306 Municipal Refuse Disposal 3 Credits****Grading Scheme:** Letter Grade

Quantities and characteristics of municipal refuse and hazardous materials. Collection methods, transfer stations, equipment and costs. Refuse disposal practices, regional planning and equipment.

**ENV 5518 Field Methods in Environmental Hydrology 3 Credits****Grading Scheme:** Letter Grade

Field methods for characterizing sites for environmental and hydrologic evaluation. Focuses on subsurface systems and ground water interactions.

**Prerequisite:** Coursework including introductory concepts of fluid flow.

**ENV 5619 Principles of Sustainable Engineering Design 3 Credits****Grading Scheme:** Letter Grade

Principles of Sustainable Engineering Design is a 3-credit hour course for civil and environmental engineering seniors and graduate students. Students will learn the meaning of sustainability and sustainable development and how those concepts apply to the planning, design and operation of civil infrastructure.

**ENV 6043 Life Cycle Assessment 3 Credits****Grading Scheme:** Letter Grade

Life Cycle Assessment

**ENV 6126 Air Pollution Control Design 3 Credits****Grading Scheme:** Letter Grade

Design, analysis, operational limitations, cost and performance evaluation of control processes and equipment. Field visits to and inspection of industrial installations.

**Prerequisite:** Undergraduate coursework including Differential Equations, Physics and Chemistry.

**ENV 6130 Aerosol Mechanics 3 Credits****Grading Scheme:** Letter Grade

Generating, collecting, and measuring aerosols. Theory of fluid dynamic, optical, electrical, inertial, and thermal behavior of gas-borne particles.

**Prerequisite:** Undergraduate coursework including Differential Equations, Physics and Fluid Mechanics.

**ENV 6301 Advanced Solid Waste Containment Design 3 Credits****Grading Scheme:** Letter Grade

Current practice in designing solid and hazardous waste landfills, waste piles, monofills, and surface impoundments. Regulations, siting, sizing, liners, leachate and gas management, operations, closure, and post-closure.

**ENV 6416 Advanced Stormwater Control Systems 3 Credits****Grading Scheme:** Letter Grade

Chemical, physical, biological and hydrologic aspects of rainfall-runoff; and control through unit operations and processes (UOP); interactions between hydrologic processes; water chemistry, sediment transport, infrastructure materials and UOPs; constituent physical properties, chemistry and loads related to design of UOPs for control, treatment and/or reuse.

**Prerequisite:** Undergraduate coursework in water chemistry and water & wastewater treatment.

**ENV 6435 Advanced Water Treatment Process Design 3 Credits****Grading Scheme:** Letter Grade

Design of selected water treatment processes including disinfection, air stripping, adsorption, ion exchange and membrane processes.

**Prerequisite:** Undergraduate course work in water and/or wastewater treatment process design, calculus, and chemistry.

**ENV 6437 Advanced Wastewater System Design 3 Credits****Grading Scheme:** Letter Grade

Layout and design of sanitary sewage systems, pumping stations, force mains, wastewater treatment plants, and methods of effluent disposal. Emphasizes preparing design drawings and estimating costs.

**Prerequisite:** Undergraduate coursework including water and wastewater treatment;

**Corequisite:** Undergraduate coursework including hydraulic system design.

**ENV 6438 Advanced Potable Water Systems Design 3 Credits****Grading Scheme:** Letter Grade

Design of water treatment operations, including coagulation, flocculation, mixing, sedimentation, filtration, softening, corrosion control, and sludge management. Design costs.

**Prerequisite:** Undergraduate course work in water and/or wastewater treatment process design, hydraulics, and chemistry.

**ENV 6439 Activated Carbon: Environmental Design and Application 3 Credits****Grading Scheme:** Letter Grade

Theory and application of manufacturing activated carbon, its use in water treatment/remediation (i.e., design of activated carbon systems), and thermal reactivation.

**ENV 6441 Water Resources Planning and Management 3 Credits****Grading Scheme:** Letter Grade

Principles and practice of water resource planning and management. Protocols used at local, state, federal, regional, and international levels. Plan formulation, evaluation, and implementation. Stakeholder involvement in planning processes. Analytical tools. Case studies.

**ENV 6455 Microbiology of Environmental Engineering Systems 3 Credits****Grading Scheme:** Letter Grade

Divided into three sections that will introduce the morphological and metabolic characteristics of microbial groups and discuss the role of microorganisms in natural (water, soil, and air) and environmental engineered systems.

**ENV 6508 Wetland Hydrology 3 Credits****Grading Scheme:** Letter Grade

Water flow and chemical transport in wetlands. Surface water and ground water interaction in wetlands. Constructed wetlands for water treatment.

**Prerequisite:** Undergraduate coursework in Hydrology, Hydrodynamics, or Fluid Mechanics.

**ENV 6511 Biological Wastewater Treatment 3 Credits****Grading Scheme:** Letter Grade

Theory and current research associated with biological treatment processes.

**ENV 6905 Individual Work 1-4 Credits, Max 8 Credits****Grading Scheme:** Letter Grade

Faculty-supervised individual research or study of material not covered in formal courses.

**ENV 6910 Supervised Research 1-5 Credits, Max 5 Credits****Grading Scheme:** S/U

Supervised Research

**ENV 6916 Nonthesis Project 1-3 Credits, Max 3 Credits****Grading Scheme:** Letter Grade

Nonthesis Project

**ENV 6932 Special Problems in Environmental Engineering 1-4 Credits, Max 18 Credits****Grading Scheme:** Letter Grade

Special Problems in Environmental Engineering

**ENV 6935 Graduate Environmental Engineering Seminar 1 Credit, Max 6 Credits****Grading Scheme:** S/U

Graduate Environmental Engineering Seminar

**ENV 6940 Supervised Teaching 1-5 Credits, Max 5 Credits****Grading Scheme:** S/U

Practicum course to provide students with supervised teaching experience on developing effective instructional methods and materials in engineering education.

**Corequisite:** EGS 6056.

**ENV 6971 Research for Master's Thesis 1-15 Credits****Grading Scheme:** S/U

Research for Master's Thesis

**ENV 7979 Advanced Research 1-12 Credits, Max 999 Credits****Grading Scheme:** S/U

Research for doctoral students before admission to candidacy. Designed for students with a master's degree in the field of study or for students who have been accepted for a doctoral program. Not appropriate for students who have been admitted to candidacy.

**ENV 7980 Research for Doctoral Dissertation 1-15 Credits, Max 999 Credits****Grading Scheme:** S/U

Research for Doctoral Dissertation

**LAW 6472 Natural Resources Law 3-4 Credits****Grading Scheme:** Letter Grade

Natural Resources Law