ENVIRONMENTAL ENGINEERING ENE

Department of Civil and Environmental Engineering
College of Engineering

280 Principles of Environmental Engineering and Science
Fall, Spring. 3(3-0) Interdepartmental with Civil Engineering. Administered by Civil Engineering. P: (CEM 141 or CEM 151 or LB 171) and ((MTH 132 or concurrently) or (MTH 152H or concurrently) or (LB 118 or concurrently))
Physical, chemical and biological processes related to environmental science and engineering. Environmental systems analysis with application to air, water and soil. Analysis of environmental problems and development of engineering solutions.

421 Engineering Hydrology
Fall. 3(2-2) Interdepartmental with Civil Engineering. Administered by Civil Engineering. P: CE 321 RB: STT 351 R: Open to juniors or seniors or graduate students in the College of Engineering or in the College of Natural Science or in the Department of Crop and Soil Sciences.
Hydrologic design of stormwater systems. Equilibrium hydrograph analysis, unit hydrographs, infiltration, hydrograph synthesis, and reservoir routing. Groundwater: Darcy's law, flow nets, well hydraulics, design of capture wells.

422 Applied Hydraulics
Spring. 3(2-2) Interdepartmental with Civil Engineering. Administered by Civil Engineering. P: CE 321 or ME 332 R: Open to juniors or seniors or graduate students in the College of Engineering.
Fundamentals of open-channel flow. Rapidly and gradually varied nonuniform flow analysis. Confined flows past submerged bodies, in pipe networks, and in turbo machinery. Design applications.

423 Applied Hydrologic Analysis and Design
Spring. 3(2-2) Interdepartmental with Civil Engineering. Administered by Civil Engineering. P: CE 321 and CE 421 and (CE 422 or concurrently) R: Open to students in the Department of Civil and Environmental Engineering and open to students in the Department of Geological Sciences and open to students in the Department of Biosystems and Agricultural Engineering.
Project-based work using HEC-RAS and geographic information systems (GIS) to analyze the impacts of land use changes in urban and rural watersheds; design of systems to mitigate specific impacts. Project-based work on water distribution networks, analysis using EPANET to study the use of water storage towers, pressure regulation devices, and cyclic demands.

427 Environmental Toxicology and Society
Spring of odd years. 3(3-0) Interdepartmental with Animal Science and Sociology. Administered by Animal Science. RB: ISB 200 or ISB 202 or ISB 204 or ISB 206H or BMB 200 or BS 111 or BS 110
Impact of environmental chemicals on health and modern society. Cellular and organ functions and their interface with the environment. Limitations of scientific investigation and environmental regulations.

481 Environmental Chemistry: Equilibrium Concepts
Fall. 3(3-0) Interdepartmental with Civil Engineering. Administered by Civil Engineering. P: (CEM 141 and CEM 142) or (CEM 151 and CEM 152) or (CEM 181H and CEM 182H) or (LB 171 and LB 172)
Chemistry of natural environmental systems and pollutants. Equilibrium concepts and calculations for acid-base, solubility, complexation, redox and phase partitioning reactions and processes. Applications to ecosystem analysis, pollutant fate and transport, and environmental protection.

483 Unit Operations and Processes in Environmental Engineering
Fall. 3(3-0) Interdepartmental with Civil Engineering. Administered by Civil Engineering. P: CE 280 and (CE 321 or concurrently)
Scientific basis and design of physical, chemical and biological treatment methods for the control of water and air pollution. Operation and process selection.

485 Landfill Design
Spring. 3(3-0) Interdepartmental with Civil Engineering. Administered by Civil Engineering. P: CE 280 and CE 312
Geotechnical and environmental design of solid waste landfills.

487 Microbiology for Environmental Science and Engineering
Spring. 3(3-0) Interdepartmental with Civil Engineering. Administered by Civil Engineering. P: CE 280
Fundamentals of microbiology. Application of these concepts to environmental processes such as wastewater treatment, human health and bioremediation.

800 Environmental Engineering Seminar
Fall, Spring. 1(1-0) R: Open only to Environmental Engineering majors.
Current research in environmental engineering.

801 Dynamics of Environmental Systems
Spring. 3(3-0)
Principles of mass balance, reaction kinetics, mass transfer, reactor theory in environmental engineering.

802 Physicochemical Processes in Environmental Engineering
Fall. 3(3-0) RB: ENE 801
Physical and chemical principles of air and water pollution control and environmental contaminants in water, air and soils.

804 Biological Processes in Environmental Engineering
Fall. 3(3-0) RB: ENE 801 or concurrently
Engineering of microbial processes used in wastewater treatment, in-situ bioreclamation, and solid waste stabilization.

806 Laboratory Feasibility Studies for Environmental Remediation
Spring. 3(2-4) RB: ENE 802 and ENE 804 R: Open only to graduate students in the Environmental Engineering major or Environmental Engineering-Environmental Toxicology major. Not open to students with credit in ENE 803 or ENE 805.
Analysis and characterization of contaminants in soil or water. Conceptual and preliminary design of treatment systems. Use of treatability studies to evaluate treatment options. Oral presentations and preparation of consulting reports with design recommendations.

807 Environmental Analytical Chemistry
Fall. 3(3-0) R: Open to graduate students in the Environmental Engineering major.
Techniques for measurement and analysis in environmental engineering. Sample preparation. Quality assurance.

811 Membrane Processes
Spring of odd years. 3(3-0) RB: (CE 321 or concurrently) and Calculus through differential equations, Physical chemistry
Fundamental principles and applications of membrane processes in environmental engineering, emphasizing solid-liquid separations and pressure-driven membrane systems.

821 Groundwater Hydraulics
Fall. 3(3-0) Interdepartmental with Civil Engineering. Administered by Civil Engineering.
Physical properties of porous media. Equations of flow in saturated media. Flow nets, well flow and parameter measurement. Transport processes and the advective-dispersion equation for conservative contaminants.

822 Groundwater Modeling
Spring of even years. 3(3-0) Interdepartmental with Civil Engineering. Administered by Civil Engineering. P: CE 821
Analysis and modeling of groundwater flow, surface water and groundwater interaction, and reactive contaminant transport. Applied numerical methods for solving groundwater flow and contaminant transport equations. Case studies.

823 Stochastic Groundwater Modeling
Spring of odd years. 3(3-0) Interdepartmental with Civil Engineering. Administered by Civil Engineering. P: CE 821 RB: Groundwater Hydrology, groundwater modeling
Analysis and modeling of flow and solute transport in heterogeneous aquifers. Geostatistics and variogram modeling. Upscaling and effective models. Uncertainty modeling. Perturbation methods and Monte Carlo simulation.

827 Integrated Risk Assessment of Environmental Hazards
Spring of odd years. 3(3-0) Interdepartmental with Animal Science. Administered by Animal Science. R: Open only to graduate students in the College of Agriculture and Natural Resources or College of Engineering or College of Human Medicine or College of Natural Science or College of Osteopathic Medicine or College of Veterinary Medicine.
Alternative approaches to assessing environmental and health risk. Analyzing, interpreting, and using scientific data from ecology, agriculture, environmental chemodynamics, biology, geological sciences, and toxicology in the risk assessment process.

829 Mixing and Transport in Surface Waters
Fall of odd years. 3(3-0) Interdepartmental with Civil Engineering. Administered by Civil Engineering. P: ENE 801
Waves, tides and shallow-water processes. Numerical solutions and applications of shallow-water equations to lakes, rivers and estuaries. Principles and processes of sediment transport, and dispersion of materials in surface waters. Wind-driven circulation in Lake Michigan.

861 Introduction to Risk and Reliability in Civil and Environmental Engineering
Fall. 1(1-0) Interdepartmental with Civil Engineering. Administered by Civil Engineering. Not open to students with credit in CE 810.
Characterization of variability using probabilistic and statistical methods.

880 Independent Study in Environmental Engineering
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to Environmental Engineering majors.
Solution of environmental engineering problems not related to student's thesis.

890 Selected Topics in Environmental Engineering
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 9 credits in all enrollments for this course. R: Open to students in the Environmental Engineering major.
Selected topics in new or developing areas of environmental engineering.

892 Master's Research Project
Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 5 credits in all enrollments for this course. R: Open only to master's students in the Environmental Engineering major. Approval of department.
Master's degree Plan B individual student research project. Original research, research replication, or survey and reporting on a research topic.

899 Master's Thesis Research
Fall, Spring, Summer. 1 to 8 credits. A student may earn a maximum of 24 credits in all enrollments for this course.
Master's thesis research.

999 Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 72 credits in all enrollments for this course.
Doctoral dissertation research.