ENVIRONMENTAL AND ECOLOGICAL ENGINEERING AND ENVIRONMENTAL FLUID MECHANICS-program brochure

DESCRIPTION

Coastal and ocean engineers study processes ongoing at the shoreline and construction within the coastal zone. The field involves aspects of nearshore oceanography, marine geology, and civil engineering, often directed at combating erosion of coasts or providing navigational access.

Ecological engineering is a new discipline that focuses on ecosystem design, restoration and management for the good of both nature and society. Ecological Engineers are responsible for design in marine, river and wetland restoration projects, design of waste treatment ecotechnologies (e.g., living machines), and applied research that integrates engineering design with ecological science. The goal is sustainable ecosystem design .

Environmental Engineers deal with the development, control, and management of our environmental, ecological, and water resources. They predict surface runoff from precipitation, stream flow, droughts and floods, groundwater supplies, and future water demands. Environmental Engineers determine reservoir sites for water supply, flood control, and hydroelectric power plants. They plan river, ocean, and coastal developments to control damage and improve navigation. Environmental engineering is the application of engineering principles, under constraints, to the protection and enhancement of the quality of the environment and to the enhancement and protection of public health and welfare. Environmental engineers focus on important topics such as environmental chemistry and biology, environmental hydrology, environmental hydraulics, water treatment, wastewater treatment, solid waste management, air pollution control, hazardous waste management and risk assessment, noise pollution and control, and environmental quality modeling. Strength areas of this department include optimization of drinking water, wastewater, and hazardous site treatment processes; waste byproduct reuse, risk assessment, and environmental systems management.

RESEARCH

Current research projects in coastal engineering include: turbulence modeling, the Great Lakes Forecasting System (GLFS); acoustic sediment monitoring, analysis of low frequency lake turbulence and sediment transport. These projects are conducted under the direction of Drs. Keith Bedford, Diane Foster and Tom Lippmann. Current research projects in ecological engineering include: dam removal and river restoration, spatial models of coastal watersheds, coral reef ecosystems and management, and wetland research. For more information contact Dr. Tim Granata, and affiliated engineering faculty, Jay Martin. Current research areas in environmental engineering include: coagulation-flocculation and colloid stability, optimization of advanced oxidation processes, engineered and natural photochemical transformation of pollutants, drinking water membrane treatment, sediment remediation, mitigation of acid mine drainage; coal combustion byproduct reuse, use of biocompatible materials for water treatment, filamentous bulking, ecosystem theory, contaminant transport in groundwater and surface water, environmental assessments, water conservation, water pricing, water usage time series and projection, effect of land use on river biological integrity, and research on unit processes as well as environmental studies on applied chemistry and biology. Please see specific pages of Drs. Audeen Fentiman, John Lenhart, Bob Sykes, Hal Walker, Linda Weavers, Earl Whitlatch, Patrick Fox, Bill Wolfe and Tarunjit Butalia for more details on these projects. Drs. Yo Chin, Frank Schwartz, and Bill Mitsch are affiliated faculty in environmental and water resources engineering. Instrumentation and other laboratory facilities available for graduate student research are extensive and allow a broad range of investigations including the development of topics of special interest.

FACILITIES

Being one of the university, college, and department-designated key technology areas, there is a wide variety of institutional and academic resources available to support the environmental program. For example, the department participates in the Program of Excellence in Molecular and Environmental Surface Science and the NSF-sponsored Environmental Molecular Science Institute (EMSI). The department is home to the Director of the Ohio Water Resources Center, Earl Whitlatch, and affiliated faculty member Bill Mitsch is director of the Olentangy River Wetland Research Park. The department is home to the Center for

Mapping and the NASA Center for Commercialization of Space and therefore has excellent facilities for image analysis and understanding, real-time satellite data analysis, and mobile environmental mapping. The department participates in the OSU Sea Grant program and the university facilities at Put In Bay, Lake Erie. Field studies on Lake Erie and coastal regions are also possible at the NOAA Estuarine Sanctuary at Old Woman Creek.

Computing: The department maintains specialized facilities to address the needs of our programs. The facilities are under the auspices of the College of Engineering Region 1, which is supported, in part, by a University computer fee. The physical facility consists of over 150 PCs and 40 SGI workstations. Students have 24-hour, 7 days a week access. Some are available on a walk-in basis; others provide studio settings for advanced users. At least 35 software packages are available including the Microsoft Office suite, AutoCAD, various GIS and image processing packages. In addition, research laboratories maintain specialized systems. For example, the Great Lakes Forecasting System houses an advanced computing environment for real-time coastal forecasting. Beyond the department, the flagship University computer facility is the Ohio Supercomputer Center located on campus. This facility principally supports research computing and contains Silicon Graphics Power Challenge, CRAY T3E and CRAY YMP computers as well as laboratories for advanced visualization. The University also provides an environment that gives students access to a variety of computer resources on campus, in Ohio, and on the Internet.

Field Instrumentation: Data and sample collection apparati for both physical and biological studies are numerous. The department has several types of acoustic current meters, including SONTEK ADP's and ADV's for high resolution boundary layer studies. SCAMP and ABS microstructure profilers can be coupled with the pressure transducers and thermistors to do detailed nearshore and coastal transport process studies. A CTD+ (conductivity-temperature-depth; YSI Inc.) probe for profiling or time series measurements of water properties. An AC-9 absorption-transmission spectrometer (Wet Labs) for characterizing light absorption-attenuation, as well as distributions of particulate and dissolved materials. An automated profiler for measuring vertical distributions of dissolved and suspended matter and sediment traps for collecting material. The department also maintains: Field water level recorder, Teflon-coated portable well pump, Manning samplers, Ekman dredge, and Grab samplers. Researchers also have access to Stone Lab, the OSU field research facility on South Bass Island, Lake Erie.

Research Laboratories: The department currently maintains a wet-lab and instrumentation lab with 5 large fume hoods and 2 walk-in 50 ft^2 constant temperature rooms for conducting state-of-the-art research in the area of environmental engineering. Ecological and coastal engineering facilities include lab space for preparing field studies, building and calibrating instruments, and analyzing sediment samples. Researchers in the department also have access to university facilities such as the Campus Electron Optics Facility, OSU Microscopic and Chemical Analysis Research Center, and Campus Chemical Instrument Center (CCIC). State-of-the-art analytical equipment includes: Varian inductively coupled plasma atomic emission spectrometer (ICP-AES), Varian graphite furnace atomic absorption spectrometer (GFAAS), Thermo Finnigan PolarisQ gas chromatograph with mass spectrometer (GC-MS), Agilent gas chromatograph with electron capture detector (GC-ECD), Agilent high performance liquid chromatograph with diode array detector (HPLC), Agilent capillary electrophoresis system (CES), Dionex ion chromatograph (IC), Shimadzu 5000A Total Organic Carbon Analyzer (TOC), Shimadzu double-beam UV/Vis spectrophotometer, Shimadzu fluorescence spectrometer, Fourier Transform Infrared Spectrometer, Beckman photon correlation spectrometer, Malvern Mastersizer low angle laser diffraction instrument, ZetaPlus Electrophoretic Light Scattering instrument, and Hach turbidity meter. State-of-the-art laboratory equipment includes: Millipore Milli-Q water purification system, pH and conductivity meters, portable pH and conductivity meters, Mettler digital analytical balances, Beckman ultracentrifuge, 6-place automatic Soxhlet extractor, Radiometer automatic titrator, low flow peristaltic and Teflon double-diaphragm pumps, muffle and evaporative ovens, ozone generator, Near-field acoustical processor, 20 kHz ultrasonic probes, ELAC-Nautik multifrequency ultrasonic laboratory reactor, Oriel 500W arc lamp source with mercury-xenon lamp, constant temperature reticulating baths, phase contrast microscope, and 10 personal computers with associated hardware. The wide variety of research activities of the staff and the high faculty-to-student ratio of the program provides unique and interesting opportunities for research by graduate students.

Instructional Laboratory: The environmental engineering instructional laboratory used in CE 610 and CE 620 is located in room 008 Hitchcock Hall. The 16-seat facility contains state-of-the-art equipment to perform laboratory and field analysis of natural, polluted, and treated waters. Laboratory apparati are available to perform treatability and water and wastewater unit process experiments. Typical laboratory experiments performed in CE 610 include the analysis of water parameters such as alkalinity, solids, hardness, nutrients, and atrazine using standard methods. In CE 620 the analysis of water is applied to investigate unit processes at water and wastewater treatment plants. Equipment: reverse osmosis water purification system, spectrophotometers, muffle oven, evaporative oven, pH meters, filtration apparatus, vacuum pump, peristaltic pumps, scales, centrifuge, turbidity meter, dissolved oxygen meter, six-jar stirrers, settling columns, Imhoff cones, plug flow reactor, complete mixed reactors, stir plates, mechanical stirrer, shaker table, grab samplers, Manning samplers.

FACULTY

Keith Bedford, ***Professor, Ph.D., Cornell University*** (coastal engineering, hydraulics, & transport phenomena); E-mail: bedford.1@osu.edu

Audeen Fentiman, ***Associate Professor, Ph.D., The Ohio State University*** (radioactive waste management, environmental risk management, and engineering education);
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Diane Foster, ***Assistant Professor, Ph.D., Oregon State University*** (interaction of fluid flows and the sea bed in coastal zone); E-Mail: foster.316@osu.edu.
Tim Granata, ***Assistant Professor, Ph.D., P.E., University of California, Berkeley*** (interaction of fluid flows with ecosystems, ecological engineering); E-Mail: granata.6@osu.edu.
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Linda Weavers, P.E., ***Associate Professor and John C. Geupel Chair, Ph.D., P.E., California Institute of Technology*** (advanced oxidation processes, sediment remediation, industrial wastewater treatment). E-mail: weavers.1@osu.edu
Earl Whitlatch, ***Associate Professor, Ph.D., Johns Hopkins University*** (environmental and water resource systems management and policy; mathematical programming, statistics, and applied economics); E-mail: whitlatch.1@osu.edu

ACADEMIC PROGRAM

Our Environmental Engineering and Environmental Fluid Mechanics academic programs offer a strong core of graduate study in the five sub-areas of Coastal Engineering, Ecological Engineering, Environmental Engineering, Environmental Fluid Mechanics, and Water Resource Systems Engineering. Our program also offers graduate opportunities for non-engineering undergraduate majors through the Environmental Science and Water Chemistry option. Please see our table below for courses offered in these areas in our department. Supporting courses provided by other departments include: statistics, systems engineering, environmental law, chemical engineering, microbiology, mathematics, economics, chemistry, soil science, geochemistry, nuclear safety, air pollution, wetlands, and hydrogeology. Program design is flexible to suit the individual interests of graduate students.

COURSE OFFERINGS

CE610	Analysis of Natural & Polluted Waters
CE613	Applied Hydrology
CE618	Ecological Engineering
CE620	Treatment Plant Design Laboratory
CE624	Coastal and Ocean Engineering
CE640	Civil and Environmental Systems Engineering
CE694	Geophysical Flows and Ecological Processes
CE711	Biological Processes for Used Water Treatment
CE714	Hazardous Waste Management
CE715	Water Resource Systems: Water Supply
CE717	Municipal & Industrial Solid Waste Management
CE 718	Strategies for Industrial Environmental Management
CE719	Water Quality Modeling
CE720	Environmental Engineering Risk Assessment
CE722	Open Channel Hydraulics
CE723	Transport Phenomena in Water Res Engrg
CE750	Seepage in Permeable Materials
CE760	Civil & Environmental Engineering Planning
CE771	Radioactive Waste Management
CE804	Water Resources Application of Remote Sensing
CE810	Physical Chemical Treatment Processes I
CE812	Physical Chemical Treatment Processes II
CE813	Hazardous Waste Site Remediation
CE814	Industrial Wastewater Treatment
CE815	Advanced Water Resource Systems: Water Quantity
CE816	Environmental Systems Analysis
CE817	Applied Mathematical Ecology
CE818	Application of Biotechnology to Environmental Engrg
CE820	Advanced Hydrology
CE821	Sediment Transport & Engineering
CE823	Numerical Models in Water Resources Engineering

CE824	Advanced Coastal Engineering
CE850	Advanced Seepage in Permeable Materials
CE 894a	Advanced Ocean Engineering
CE 894b	Turbulence in Environmental Flows
CE 894c	Time Series and Spectral Analysis Methods for Earth Scientist and Engineers
CE899	Departmental Seminar in Ecological Engineering

For description of the contents of the above courses, reference should be made to the University Bulletin: *Course Offerings*, available from the Graduate School upon arrival on campus or the individual web pages..

SAMPLE CURRICULA

Sample M.S. curricula for each of the five sub-areas are given below. See General CE Grad Brochure, for a specific curricula guide and courses. Each sample of the Plan A, curricula includes 36 course credits plus an additional 9 credits of research. Actual student curricula are decided on an individual basis.

Coastal Engineering

Fall	*Winter*	*Spring*
CE 723 (4 cr)	CE 824 (4 cr)	CE 894a (3 cr)
CE 894b (4 cr)	CE 894c (3 cr)	CE 821 (4 cr)
	CE 823 (4 cr)	CE 714 (3 cr)
Math 707 (3 cr)	Math 708 (3 cr)	Math 709 (3 cr)

Ecological Engineering

Fall	*Winter*	*Spring*
CE 719 (3 cr)	CE 618 (4 cr)	CE 899 (2 cr)
CE 817 (5 cr)	CE 694 (4 cr)	FABE 652 (4 cr)
CE 820 (5 cr)	NR 760 (5 cr)	CE 722 (4 cr)

Environmental Engineering

Fall	*Winter*	*Spring*
CE 719 (3 cr)	CE 711 (4 cr)	CE 714 (3 cr)
CE 723 (4 cr)	CE 812 (4 cr)	Geol 718 (5 cr)
CE 810 (4 cr)	Stat 528 (3 cr)	Stat 529 (3 cr)
CE 814 (3 cr)		

Environmental Fluid Mechanics

Fall	*Winter*	*Spring*
CE 723 (4 cr)	CE 824 (4 cr)	CE 722 (4 cr)
CE 894b (4 cr)	CE 894c (3 cr)	CE 821 (4 cr)
	CE 823 (4 cr)	CE 714 (3 cr)
Math 707 (3 cr)	Math 708 (3 cr)	Math 709 (3 cr)

Water Resource Systems Engineering

Fall	*Winter*	*Spring*
CE 640 (4 cr)	CE 711 (4 cr)	CE 714 (3 cr)
CE 719 (3 cr)	CE 812 (4 cr)	CE 717 (4 cr)
CE 810 (4 cr)	Stat 528 (3 cr)	Stat 529 (3 cr)
CE 814 (3 cr)		