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Ecological Engineering

Distance Education Courses - Spring 2012



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BAE 582 Risk and Failure Assessment of Stream Restoration Structures

Credits: 1 - Offered Spring
Prerequisite: CE 382 or MAE 308 or equivalent

This course defines uncertainty and risk pertaining to stream restoration structures and identifies and quantifies sources of such. Students will review various in-stream structures and, using an example study of the rock cross vane as a guide, will investigate a structure of their choice applying the concepts of risk and uncertainty. Modules include: Introduction to structures and definitions; Types and modes of failure; Uncertainty in Stream Restoration Design; Probability of failures, cost of failures; and Failure modes and effects.



BAE 583 Ecohydraulics and River Corridor Function

Credits: 1 - Offered Spring
Prerequisite: CE 382 or MAE 308 or equivalent

This course provides an ecological perspective of lotic systems and introduces students to ecological processes that structure river corridors. This course defines hydraulic, hydrologic, chemical, sedimentary, and biotic influences on an aquatic ecosystem. The five modules define components of aquatic ecosystems and their interactions, and explore ecological implications of engineered designs and cause-effect relationships from the watershed scale down to individual organisms. This course assumes students gain a working knowledge of general biological and physical principles related to fluvial ecosystems



BAE 590 Wetlands – 2 Credits

Prerequisites: Senior or graduate standing
Fundamental understanding of hydrology, soils and ecology of natural wetland systems will be developed to serve as the basis of designing wetland systems for water treatment and restoring degraded natural wetland systems. Stormwater and wastewater treatment wetland design and implementation concepts will be emphasized. Wetland restoration will also be studied with emphasis on current wetland regulations, design, and implementation techniques. Engineered wetland concepts will be supplemented with relevant case studies. Basic understanding of biology (BIO 181), soils (SSC 200) and soil and water engineering (BAE 471) recommended.

BAE 590-604 Biogeochemical Processes for Ecological Engineering—3 Credits

Prerequisite: Aquatic Chemistry, Ecology, or Hydrology
The course provides the detailed theoretical knowledge required for Ecological Engineers to better design natural systems and for watershed planners to better understand and protect water quality. The course particularly applies to naturally occurring and human-designed filters, which may reduce excess nutrient concentrations and loads in rural and suburban environments. Systems reviewed include wetlands, riparian buffers and vegetated filter strips, streams, stormwater ponds and bioretention zones. Emphasis will be given on the linkage between the micro-scale biogeochemical processes, the transport of water and nutrients to the micro-sites, and the apparent functioning at the whole system scale. The course focuses on the major nutrient and pollutants of concern including carbon, nitrogen, phosphorus, sulfur, suspended solids and pesticides.

Coming Fall 2012

- BAE 528 Biomass to Renewable Energy Processes
- BAE 576 Watershed Monitoring and Assessment
- BAE 578 Agricultural Waste Management
- BAE 580 Introduction to Land and Water Engineering
- BAE 590-601. Introduction to Fluvial Geomorphology
- BAE 590-602 Integrating AutoCAD Civil3D and GIS
- BAE 590-601: Introduction to Fluvial Geomorphology
- BAE 590-604 Biogeochemical Processes for Ecological Engineering

Hydrology/Environmental

BAE 590-604 Sustainable Low Impact Development -- 2 Credits

Prerequisite: Senior or graduate standing
Low Impact Development (LID) is a stormwater management design



framework aimed at minimizing the negative impacts of stormwater runoff by mimicking the pre-development hydrology of a site. This course addresses LID in the contexts of design, planning, implementation, and maintenance. Low impact development is viewed holistically as a vital component to a larger, systematic approach to development. Upon completion of this course, students apply principles learned in design and review scenarios, and identify

BAE 590 DRAINMOD: 3 credits

Prerequisite: Good background in soil and water processes, hydraulics or soil physics.

DRAINMOD is a computer simulation model that may be used to describe the hydrology and drainage water quality of poorly drained soils, including wetlands.



The course will cover the theory of DRAINMOD with detailed attention to hydrologic processes including drainage, ET, runoff, seepage, water table depth. The latest version of the model, DRAINMOD 6.1 will be used in the course. A wide range of model applications will be addressed through demonstrations and problems assignments including: wetland hydrology, stormwater retention basins, drainage design and management, effort of drainage design on wastewater treatment and N loss in drainage water.

BAE 502 Instrumentation for Hydrologic Applications — 3 credits

Prerequisite: MA 341, BAE 401 or ECE 331, ST 370. Data collection is at the heart of almost all research in physical sciences. In this course, students will learn fundamentals of measurement theory, characteristics of sensors, basics of data loggers, and basic data management and processing. Topics include: physical parameters of interest, available methods, sensors for assessment, sensor characteristics, data loggers and sensor-data logger communications, and data transfer, management, and processing. Emphasis on hydrologic and water quality research applications.

GIS Modeling and Applications

BAE (SSC) 535 Precision Agriculture Technology: 3 credits. Offered Spring Even Years

Prerequisite: Junior standing or Senior standing
Overview of technology available for implementation of a comprehensive precision agriculture program. Topics include computers, GPS, sensors, mechanized soil sampling, variable rate control system, yield monitors, and postharvest processing controls. Applications of precision agriculture in crop planning, tillage, planting, chemical applications, harvesting and postharvest processing .

BAE 590-602 GIS Applications for Precision Agriculture -- 1 Credits

Prerequisite: Experience with ArcGIS is recommended but not required.



This course is designed to address some of the specific applications of GIS in Precision Agriculture. Exploration of geographic information systems (GIS) and its applications in precision agriculture. Topics will include file structure and formatting, interfacing with precision agriculture equipment, georeferencing maps, merging and clipping farm data, data field calculations, designing management zones, variable rate prescriptions, and basic data analysis.

BAE Graduate Courses

Number	Course Title
BAE 502	Instrumentation for Hydrologic Applications
BAE 528	Biomass to Renewable Energy Processes
BAE 535	Precision Agriculture Technology
BAE 572	Irrigation and Drainage Engineering
BAE 573	Hydrologic & Water Quality Modeling
BAE 575	Design of Structural Stormwater BMPs
BAE 576	Watershed Monitoring and Assessment
BAE 578	Agricultural Waste Management
BAE 579	Stream Channel Assessment & Restoration
BAE 581	Open Channel Hydraulics for Natural Systems
BAE 582	Stream Restoration Structure Risk & Failure
BAE 583	Ecohydraulics & River Corridor Function
BAE 590-606	GIS Applications in Precision Agriculture
BAE 590-607	GIS Applications in Hydrologic Modeling and Water Quality
BAE 590-608	Biogeochemical Processes for Ecological Engineers
BAE 590B	Aerosol Mechanics
BAE 590-003	Agricultural Air Quality
BAE 590-601	DRAINMOD
BAE 590-602	Fluvial Geomorphology
BAE 590-605	Integrating AutoCAD Civil3D and GIS
BAE 590-004	Embedded Controls in Agriculture
BAE 590-603	Introduction to Land & Water Engineering
BAE 590	Biomass Harvesting, Handling, Transportation and Logistics
BAE 771	Theory of Drainage—Saturated Flow
BAE 774	Theory of Drainage—Unsaturated Flow

*Course offerings and course numbers are subject to change. Please visit the BAE grad studies site for more information

<http://www.bae.ncsu.edu/grad/>