BEE 475. Environmental Systems Analysis
Fall Semester 2009

Credit: 3 hours

Catalogue description:
Applications of mathematical modeling, simulation and optimization to environmental quality management. Fate and transport models for contaminants in air, water and soil. Optimization methods (search techniques, linear programming) to evaluate alternatives for solid waste management and water and air pollution control. Introduction to hydrologic simulation (runoff and streamflow).

Required or elective: Required

Prerequisites: Calculus and Computer Applications

Textbook(s) and other required materials: None. Lecture notes, supplementary reading on course web site (Blackboard).

Course objectives:
1. To develop an ability to quantify the movement, transformations and impacts of wastes in an environmental medium.
2. A facility for the use of optimization and simulation techniques to understand and manage environmental problems.
3. An understanding of systems analysis as a quantitative engineering problem-solving technique involving mathematical modeling of problems, computer simulations of systems and evaluation of alternative solutions.

Topics covered:
Introduction to environmental systems, modeling & optimization
Modeling of watersheds & lakes
Model linearization; linear programming
Air pollution modeling: proportional rollback, Gaussian transport, emissions trading
Location of waste disposal facilities, integer linear programming
Dissolved oxygen in streams and rivers; waste load allocation
Groundwater models: hydrologic processes & water balance, nitrate pollution
Groundwater models: leaching & transport of organic chemicals
Nonpoint source pollution: simulation of contaminants in runoff
Watershed modeling: simulation of water & chemicals balance in large watersheds
Water resources applications: water allocation & reservoir operation; benefit estimation, fuzzy objectives

Class/laboratory schedule:
Two 75-minute lectures per week

Course outcomes and their relation to ABET program outcomes a-m:
1. An ability to quantify the movement, transformations and impacts of wastes in an environmental medium. (k)
2. A facility for the use of optimization and simulation techniques to understand and manage environmental problems. (l)
3. An understanding of systems analysis as a quantitative engineering problem-solving technique involving mathematical modeling of problems, computer simulations of systems and evaluation of alternative solutions. (c, e)

Course Webpage: Blackboard

Person preparing this description and date:
D. A. Haith, 1/10/10
Ethical behavior statement:

Hard-copy problem write-ups are due by the end of class on the assignment date. Students may work individually or in pairs (2 people). Paired work should be submitted as a single write-up with both names. Students may not change partners during the semester unless they have permission of the instructor. They may, however, elect to submit some problems as individuals and some as (the same) partners. Pairs or individuals are expected to work reasonably independently. That is, each student or pair may discuss and compare their work with other students and/or pairs, but must be responsible for their own analyses, spreadsheets, software runs, and reports. Problem solutions will be posted in the display case next to the elevator on Riley-Robb 3rd floor. Late problem sets will be permitted only on written verification of health or family emergencies.