CE 8933. Water Quality Modeling II
Spring 2009

General

Instructor: James L. Martin, Ph.D., P.E., D. WRE, F. ASCE
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325-7194
Office Hours: TBA

Time: MWF 1:00-1:50
Location: Simrall 106

Description: (Prerequisite: Consent of instructor). Three hours lecture. Advanced topics related to surface water quality modeling including an overview of the present state-of-the-art of modeling and analysis of eutrophication and toxic materials (organic chemicals and metals) and review of recent trends.

Textbook: Chapra, Steven C. 1997. Surface Water-Quality Modeling. McGraw-Hill, or Waveland Press. 844 pp.

Reference:

1. Thomann, R.V. and J.A. Mueller. 1987. Principles of Surface Water Quality Modeling. Harper-Collins. 644 pp.
2. Martin, J.L. and S.C. McCutcheon. 2000. Hydrodynamics and Transport for Water Quality Modeling. Lewis Publishers, Boca Raton, Fl., 794 pp.

Grading:

Tests (2-3)	50%
Homework, special assignments/projects	50%

Grading criteria:

- Individual problems from homework assignments; potential pop-quizzes will count equally for homework.
- Homework submitted after announced due date will not be graded unless prior arrangements made
- Projects will be selected based upon student interest and consent of instructor and include both written and oral presentations

Learning outcomes:

- Provide students with understanding of the modeling methods used by various states and federal agencies for allocating waste loads and analyzing clean up alternatives.

- Enable students to perform modeling analysis for both conventional and toxic materials as well as provide hands-on experience with representative models in common use.
- Complement CEE's research program in water quality modeling and sedimentation engineering

Course Outline

1. Introduction (4 hours)
    a. Overview of water quality modeling and this course
    b. Development of fundamental equations
        i. Instantaneous equations
        ii. Properties of Water
        iii. Reynolds averaged equations
2. Model complexity and selection
3. Solution Techniques
    a. Analytical
    b. Numerical
4. Coupling of models of water quality and flow (hydrodynamics)
5. Model Data Requirements
    a. Boundary conditions and loads
    b. Initial conditions
    c. Model calibration
    d. Model evaluation
6. Model Uncertainty
7. Overview of Conventional Pollutants
    a. Water temperature
    b. Dissolved oxygen and nutrients
    c. Eutrophication
8. Comparison and contrasts: Conventional Water Quality Models
    a. QUAL2EU
    b. CE-QUAL-RIV1
    c. QUAL2K
    d. CE-QUAL-W2
    e. LAKE2K
    f. WASP Versions 6 and 7
    g. CE-QUAL-ICM
9. Models of Toxic Organics
    a. Overview of processes impacting toxic organics
    b. Examples of models and modeling approaches
10. Models of radionuclides, metal speciation and transport
    a. Overview of processes impacting radionuclides and metals
    b. Examples of models and modeling approaches
11. Models of metalloids (mercury)
    a. Overview of processes impacting mercury

    b. Modeling approaches
12. The Watershed paradigm and model linkages
    a. Hydrology
    b. Hydraulics
    c. Meteorology