

Course Syllabus

CE542 - Water Quality Modeling

Credits: 3

Prerequisites: Two semesters of chemistry, one course in hydrology or water quality.

Course Instructor: *Larry Roesner*, Eng. A214

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Course Description: The management of water quality is a key requirement for a healthy environment. Engineers have a major responsibility in this area and they need good modeling tools to assist them in their task. This course will provide an introduction to surface water-quality modeling. Modeling fundamentals are covered, including background material on mathematics, numerical methods, reaction kinetics, diffusion, etc. Water-quality modeling environments that are discussed include streams and lakes. Specific water-quality modeling problems that may be covered include dissolved oxygen, eutrophication, temperature, and pH. Students will apply the QUAL2K mathematical model in the course, including common models used in practice.

Textbook: Chapra, S.C., Pelletier, G.J. and Tao, H. 2005. *QUAL2K: A Modeling Framework for Simulating River and Stream Water Quality, Version 2.04: Documentation and Users Manual*. Civil and Environmental Engineering Dept., Tufts University, Medford, MA., Steven.Chapra@tufts.edu

Course Format: Three lectures per week, in-class model application and simulation

Course Objectives: Students will accomplish the following in this course:

- Gain an understanding of the concepts of numerical modeling and time series as applied to water quality modeling.
- Gain an understanding of water-quality processes such as reaction kinetics, diffusion and eutrophication.
- Apply and evaluate the results of water-quality models such as QUAL2K
- Learn the basics of modeling stratified lakes and reservoir, and passive turbulent diffusion plume modeling
- Apply and evaluate sensitivity analysis of models.

Course Topics:

- Introduction to Modeling
- Basics of Model Formulation
- Basic Mathematical Formulation
- Process Mathematical Descriptions
- Lake Temperature and Water Quality Modeling
- Plume Modeling
- Eutrophication Modeling
- Environmental Chemistry and Toxic Substances