CE 572: Analysis & Modeling of Aquatic Environments

Course Description:

Principles of surface water flows and mixing. Introduction to hydrologic transport and water quality simulation in natural water systems. Advection, diffusion and dispersion, chemical and biologic kinetics, and water quality dynamics. Applications to temperature, dissolved oxygen, primary productivity, and other water quality problems in rivers, lakes and reservoirs. Deterministic vs. stochastic models.

Course objectives (course designed to provide students with):

1. To understand the mechanism and interactions that give rise to various types of water quality behavior by formulation and testing of hypothesis of cause–effect relationships between waste (pollutant) inputs and resulting water quality (WQ) in surface waterbodies (rivers, streams, lakes, reservoirs, and estuaries).
2. To provide a rational base for making WQ control decisions by prediction of WQ and changes in response to pollutants inputs and other boundary conditions and evaluate control measures and find effective ones.

Course Topics

- Reaction kinetics
  - loading, flow mixing, mass transport
- Input-output (CSTR) model
  - exact and numerical solutions
- Advection-diffusion (A-D) model
  - exact solutions
- Rivers and streams
- Estuaries, lakes and impoundments (reservoirs)
- Dissolved Oxygen
  - kinetic relationships, mass balance
  - applications to rivers, estuaries and lakes
- Eutrophication
  - mechanism, sources of nutrients, kinetics, food chains
  - input-out models and applications to lakes
- A-D models and applications to eutrophication in rivers
- Temperature
  - heat transfer, stratification and water quality temperature models
- Toxic substances:
  - kinetics, particle/contaminant interactions
  - Toxics models for lakes, rivers and estuaries