Department of Civil and Environmental Engineering
School of Mining and Petroleum Engineering

CIV E 525 – ENVIRONMENTAL WATER QUALITY MANAGEMENT

INSTRUCTOR

Yaman Boluk
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OFFICE HOURS *(tentative)*

Tuesday and Thursday (2:00PM to 3:00PM)
Donadeo ICE 7-273

LECTURE TIME & LOCATION

Tuesday and Thursday (11:00AM to 12:20PM)
NRE 2-016

GRADE DISTRIBUTION

Final Examination	50 %
Mid-Term Examination	30 %
Assignments (*4 in total)*	20 %

RECOMMENDED TEXTBOOKS

Surface Water Quality Modeling, Chapra, Waveland Press, 1997. (Supplementary-Recommended) [formerly published by McGraw-Hill]

Thomann, R.V. and Mueller, J.A. 1987. Principles of Surface Water Quality Modeling and Control. Harper and Collins Publishers Inc., New York).

COURSE DESCRIPTION

Principles of water quality and systems analysis of rivers and lakes. Mathematical methods for modeling environmental systems. Application of models to generic substances within various systems (rivers, lakes). Incorporating different mass transfer (advection-dispersion, diffusion, volatilization) and mass transformation (e.g., biodegradation, hydrolysis) processes in the mathematical model. Introduction to more complex environmental conditions such as dissolved oxygen, nutrients, and eutrophication.
Prerequisite: ENV E 325; corequisite: ENV E 320.

LEARNING OUTCOMES

- Understand and evaluate water quality regulations and their implications for environmental management.
- Analyze reaction kinetics and mass balance principles to solve water quality problems.
- Formulate mathematical mode from conceptual problem statements, including understanding simplification methods and the importance of boundary and initial conditions.
- Develop analytical and numerical solutions to water quality modeling problems in lake and river systems.
- Model transport processes including advection, diffusion, and dispersion in natural water systems.
- Identify and explain the bio-physical processes affecting water quality, such as dissolved oxygen, nutrients, phytoplankton, and pathogenic bacteria, and incorporate these processes into modeling frameworks.

ASSIGNMENTS

- Assignments are to be uploaded to the dropbox on Canvas by 4:30 pm on the due date.
- Late assignments will be penalized at the rate of 20% of the total grade per day.

COURSE OUTLINE

Topics	# of lectures
Course Overview & Introduction	**0.5**
1. Water Quality Requirements and Regulations	**1.5**
2. Introduction to Water Quality Modeling	**2**
3. Reaction Kinetics and Mass Balance Modeling	**2**
4. Modeling Lake Systems	
4.1. Mass Balance, Steady-state Solution and Residence Time	**2**
4.2. Particular Solutions for Loading Function	**2**
4.3. Multicompartment Models	**1**
Midterm Exam (*tentative* October 14, 2025)	**1**
5. Transport Processes	
5.1. Advection, Diffusion and Dispersion	**1**
5.2. Transverse Mixing in Natural Streams	**2**
6. Modeling River Systems	
6.1. Advection-Dispersive Systems	**2**
6.2. Mass Input into Rivers	**3**
Fall Term Reading Week - November 11 to 15, 2025	
7. Dissolved Oxygen	
7.1. BOD and Oxygen Saturation	**1**
7.2. Modeling Dissolved Oxygen in Rivers	**1**
7.3. River Under Anaerobic Condition	**1**
8. Indicator Bacteria, Pathogens & Viruses	**1**
9. Eutrophication	**1**
Final Exam *(tentative December 11, 2025)*	