STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

MASTER SYLLABUS

CIVL 323 – Environmental Engineering

CIP Code: 14.0805

Created by: Adrienne C. Rygel
Updated by:

School: Canino School of Technology
Department: Civil and Construction Technology
Implementation Semester/Year: Fall 2026

A. TITLE: Environmental Engineering

B. COURSE NUMBER: CIVL 323

C. CREDIT HOURS (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity):

# Credit Hours per Week	**4**
# Lecture Hours per Week	**3**
# Lab Hours per Week	**3**
Other per Week	

D. WRITING INTENSIVE COURSE:

Yes	
No	x

E. GER CATEGORY:

Does course satisfy a GER category(ies)? If so, please select all that apply.

[1-2] Communication	
[3] Diversity: Equity, Inclusion & Social Justice	
[4] Mathematics & Quantitative Reasoning	
[5] Natural Science & Scientific Reasoning	
[6] Humanities	
[7] Social Sciences	
[8] Arts	
[9] US History & Civic Engagement	
[10] World History & Global Awareness	
[11] World Languages	

F. SEMESTER(S) OFFERED:

Fall	x
Spring	
Fall and Spring	

G. COURSE DESCRIPTION:

This course introduces students to environmental engineering. Course content expands upon concepts of basic chemistry to study areas of aqueous chemistry, wastewater, solid waste, and air pollution. Students expand their knowledge in chemistry with study of equilibrium chemistry concepts and problems. Specific topics include the physical, chemical, and biological characteristics of water and the significance and interpretations of water quality properties. The impact of metal redox reactions and agricultural runoff on metal, nutrient, and solids loading in surface water bodies is tested and evaluated. Characterization, transport, and

management of solid waste and air quality pollutants is studied. Environmental and engineered systems are modeled in order to study mass balance, contaminant fate, and reaction kinetics. Concepts of risk assessment are also introduced. Laboratory sessions use standard water quality testing practices that are currently used in industry.

H. PRE-REQUISITES: CHEM 150 College Chemistry and MATH 161 Calculus I, or permission of the instructor

CO-REQUISITES:

I. STUDENT LEARNING OUTCOMES:

Course Student Learning Outcome [SLO]	Program Student Learning Outcome [PSLO]	GER	ISLO & Subsets
a. Explain the roles and responsibilities of public institutions and private organizations that relate to environmental engineering	SO4		ISLO4 (ER)
b. Apply key concepts of equilibrium chemistry: equilibrium constants, activity, ionic strength, and solubility products	SO7		ISLO 5
c. Establish a water sampling plan	SO7		ISLO 5
d. Measure common water and wastewater quality parameters (pH, temperature, dissolved oxygen, turbidity, color, solids analysis, alkalinity, hardness) and conduct tests for inorganic pollutants (e.g. metals and nutrients), organic pollutants (e.g. via biochemical oxygen demand, BOD), microbial contaminants (e.g. HPC plate count and coliform presence/absence test).	SO6		ISLO 5
g. Analyze and interpret environmental quality data	SO6		ISLO 5
h. Differentiate between types of solid waste and explain different methods of solid waste disposal and management	SO7		ISLO 5
i. Discuss the characteristics of air pollution, emissions and air pollution dispersion, and methods of air quality management	SO7		ISLO 5
j. Demonstrate knowledge of mass balance concepts and conduct mass balance and transport related analysis.	SO1		ISLO 5

k. Research a topic related to the course by conducting a technical literature review and prepare a written deliverable (standard report, fact sheet, or poster) and present the research findings to the class in an oral presentation.	SO3		ISLO 1 (O+W)

KEY	**Institutional Student Learning Outcomes [ISLO 1 – 5]**
ISLO #	**ISLO & Subsets**
1	**Communication Skills** Oral [O], Written [W]
2	**Critical Thinking** *Critical Analysis [CA], Inquiry & Analysis [IA] , Problem Solving [PS]*
3	**Foundational Skills** *Information Management [IM], Quantitative Lit, /Reasoning [QTR]*
4	**Social Responsibility** *Ethical Reasoning [ER], Global Learning [GL],* *Intercultural Knowledge [IK], Teamwork [T]*
5	**Industry, Professional, Discipline Specific Knowledge and Skills**

J. APPLIED LEARNING COMPONENT:

Yes	x
No	

If yes, select [X] one or more of the following categories:

Classroom / Lab	x	Community Service	
Internship		Civic Engagement	
Clinical Practicum		Creative Works/Senior Project	
Practicum		Research	
Service Learning		Entrepreneurship [program, class, project]	

K. TEXTS:

Mihelcic, James R. and Zimmerman, Julie B. (2021). Environmental Engineering: Fundamentals, Sustainability, Design", 3rd Edition, Wiley, ISBN: 978-1-119-68937-9.

L. REFERENCES:

- Mark J. Hammer and Mark J. Hammer Jr. (1997). Water and Wastewater Technology; Pearson Prentice Hall, 7th edition, ISBN 9780135114049.
- Droste, Ronald L. (1997). Theory and Practice of Water and Wastewater Treatment. New York, New York: John Wiley & Sons, Inc.
- Stumm, Werner and Morgan, James J. (1996). Aquatic Chemistry, 3rd edition. New York, New York: Wiley Interscience, , John Wiley & Sons, Inc..
- vanLoon, Gary W. and Duffy, Stephen J. (2000). Environmental Chemistry a Global Perspective. New York, New York: Oxford University Press.

- Drever, James I. (1997). The Geochemistry of Natural Waters, 3rd edition. Upper Saddle River, New Jersey: Prentice Hall.
- Langmuir, Donald (1997). Aqueous Environmental Geochemistry. Upper Saddle River, New Jersey: Prentice Hall.
- Talaro, Kathleen Park (2005). Foundations in Microbiology, 5th edition. New York, New York: McGraw Hill Higher Education.
- Tchobanoglous and Schroeder (1985). Water Quality. Reading, Massachusetts: Addison Wesley Logman.

M. EQUIPMENT:

Laboratory equipment, provided by the department will include, but is not limited to:

- Standard, regular use laboratory equipment and materials: beakers, graduated cylinders, sample collection bottles, BOD bottles, support stands and clamps, mixing plates, pipets, safety gloves, deionized water
- multimeter (pH, temperature, conductivity, total dissolved solids)
- Dissolved oxygen meter and probes
- Turbidimeters
- Alkalinity and hardness titration equipment
- Solids analysis equipment
- Filtration equipment
- Color spectrophotometer and reagents
- Microbial analysis equipment
- Reactor design equipment

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

Exams
Homework Assignments
Laboratory Assignments
Term Project

P. DETAILED COURSE OUTLINE:

I. Introduction to Environmental Engineering
   A. Evolution of environmental practice
   B. Environmental standards and regulations
   C. Sustainable Environmental Design and Approach

II. Environmental Measurements - Expressing Concentration
   A. Concentration units (% volume and % mass, mass concentration, Parts Per Million, Molality, Molarity, Normality, Mole Fraction, Mass Concentration as $CaCO_3$ equivalent)
   B. Unit Conversions

III. Data Analysis for Environmental Testing
   A. Components and use of a data set (e.g. mean, median, 5-number summary, measuring spread, variability, and distribution)

B. Displaying and analyzing data (stemplots, box+whisker plots, histograms, scatter plots)
C. Inference and significance/variance tests
D. Excel in data analysis

IV. Equilibrium Chemistry
A. Equilibrium constants
B. Ionic Strength, Activities, Solubility Products
C. Air-Water equilibrium (Henry's Law) and Volatilization
D. Acid-Base Chemistry (acids, bases, and the carbonate system)
E. Oxidation-Reduction reactions
F. Stoichiometry

V. Water Quality
A. Basic water quality parameters (pH, temperature conductivity, turbidity, total/suspended/dissolved solids, dissolved oxygen)
B. Major ion Analysis
C. Hardness, Alkalinity, and Acidity
D. Metals and redox reactions
E. Nutrients (nitrogen and phosphorus ions)
F. Organic Chemical Constituents
G. Biological Characteristics of Water

VI. Solid Waste Management
A. Solid waste characterization (sources, quantities, materials, properties, classification)
B. Components of a solid waste systems (recycling, recovery, incinerating, composting, landfill)
C. Solid waste management

VII. Air Quality Engineering
A. Types of air pollution
B. Atmospheric structure
C. Characteristics of polluted air
D. Emissions (types, courses, control, and assessment)
E. Transport and Dispersion

VIII. Environmental Reaction Kinetics
A. Flow Regimes
    1. Batch Reactor
    2. Continuously stirred tank reactor
    3. Plug flow reactors
B. Reaction Kinetics
    1. Types of reactions
    2. Zero-order reactions
    3. First-order reactions
    4. Second-order reactions
C. Mass Balance
    1. Reaction rates
    2. Batch Reactor

3. Continuously Stirred Tank Reactors
4. Plug Flow Reactors
5. Other Reactors

D. Tracer Studies
E. Mass transport equations and environmental fate

IX. Environmental Risk

A. Concept of Risk
B. Hazardous and Toxic Chemicals
C. Ethics and Risk
D. Risk Assessment

Q. LABORATORY OUTLINE:

1. Regulating Bodies, Regulations, and Standards
2. Sampling Techniques, Field/Laboratory Safety, and Analysis of Basic Water Quality Parameters
3. Data Analysis of Water Quality Data
4. Alkalinity and Hardness
5. Metals Testing Lab Part I: Sampling and Analysis Plan, field testing, and sample collection
6. Metals Testing Lab Part II: Laboratory metals analysis
7. Nutrient Analysis (phosphates, sulfates, nitrates, nitrites) Part I: field testing and sample collection
8. Nutrient Analysis Part II: laboratory testing
9. Biochemical Oxygen Demand (BOD)
10. Microbial Analysis: Determination of Heterotrophic Bacteria and Coliforms
11. Mass Balance and Reactor Design
12. Field Trip to Potsdam Water Treatment Plant
13. Student Project Presentations