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

MASTER SYLLABUS

CIVL 324 – Water and Wastewater Treatment Design

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: Water and Wastewater Treatment Design

B. COURSE NUMBER: CIVL 324

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

# Credit Hours per Week	**3**
# Lecture Hours per Week	**2**
# 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	
Spring	x
Fall and Spring	

G. COURSE DESCRIPTION:

The treatment of water and wastewater is necessary to achieve the required quality necessary for a desired end-use. This course explores different chemical, physical, and biological theory, concepts, and methods of treatment for municipal water and wastewater treatment facilities. Students learn design concepts and system operations for water and wastewater treatment plants and apply this knowledge to design components of these treatment facilities. There is also discussion of related water and wastewater quality standards and regulations. Laboratory sessions demonstrate standard water and wastewater treatment practices that are currently

used in industry, utilize bench-scale tests to optimize treatment, and allow students to design components and systems.

H. PRE-REQUISITES: CHEM 150 College Chemistry I 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 significant standards and regulations in the water industry.	SO4		ISLO 5
b. Demonstrate knowledge of chemicals and methods used for coagulation and flocculation	SO7		ISLO 5
c. Indicate knowledge and application of different filtration methods	SO7		ISLO 5
d. Indicate knowledge and application of different types of disinfectants	SO7		ISLO 5
e. Determine chemical dosages based on the stoichiometries of chemical reactions	SO1		ISLO 5
f. Explain common biological wastewater treatment processes	SO7		ISLO 5
g. Conduct basic laboratory tests for determining appropriate chemical dosing for different water treatment components (eg. jar test for coagulation flocculation alum dosage; batch tests for chemical oxidation of inorganic contaminants; chlorine demand test for disinfection, Ct tests for bacteria disinfection)	SO6		ISLO 5
h. Design the basic components that are commonly used in water or wastewater treatment plants (e.g. chemical coagulation dosages design, flocculation design, sedimentation design, filtration design, disinfectant dosages and contact time, chemical oxidant dosages and contact time)	SO2		ISLO 5
i. Research a topic related to the course by conducting a technical literature review and	SO3		ISLO 1 (O+W)

prepare a written deliverable (standard report, fact sheet, or poster) and present the research findings to the class in an oral presentation			

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., (2008). "Water and Wastewater Technology" by Pearson Prentice Hall, 7th edition, ISBN 9780135114049.
- Droste (1997). Theory and Practice of Water and Wastewater Treatment. New York, New York: John Wiley and 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, support stands and clamps, mixing plates, pipets, distilled and deionized water, safety gloves and glasses, and laboratory coats
- CSTR and PF Reactor models
- Multimeters for testing pH, conductivity, and total dissolved solids
- Dissolved oxygen meter and probes
- Turbidimeters
- Water sample filtration equipment
- Filter columns
- Microbial analysis equipment (e.g. agar plates, pipets, dilution tubes)
- HACH Color spectrophotometers and associated equipment/materials for testing ions (e.g. chlorine, metals, nutrients)
- Jar Test Apparatus

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

Exams
Homework Assignments
Laboratory Assignments
Term Project

P. DETAILED COURSE OUTLINE:

I. Introduction
   A. Water Quality Review
   B. Concepts and Theory of Water and Wastewater Treatment
      1. Overview of water treatment operations
      2. Overview of wastewater treatment operations
      3. Reactors, flow, and detention time
      4. Mass balance and fate and transport
   C. Standards and Regulations

II. Water Treatment Plants
   A. Introduction
      1. General process overview
      2. Pertinent standards and regulations
   B. Physical Treatment Processes

1. Screening
2. Coagulation and flocculation
3. Sedimentation
4. Filtration
5. Mass transfer and aeration

C. Chemical Treatment Processes
1. Disinfection
2. Chemical oxidation and removal of inorganic contaminants
3. Adsorption of organic and inorganic contaminants
4. Ion exchange
5. Softening
6. Flouridation
7. Other water finishing chemicals

III. Wastewater Treatment Plants
A. Introduction
1. General process overview
2. Pertinent standards and regulations
B. Pre-Treatment
C. Primary Treatment
D. Secondary Treatment
1. Aerobic biological treatment
2. Anaerobic wastewater treatment
3. Treatment in ponds, land systems, and wetlands
E. Tertiary Treatment
F. Sludge processing and land application
G. Alternative Systems

Q. LABORATORY OUTLINE:

1. Mass Balance and Reactor Lab
2. Water Quality Parameter Testing Review Lab
3. Coagulation and Flocculation Chemical Dosing Design Test
4. Flocculation Tank Design Calculations
5. Sedimentation Design
6. Sedimentation Calculations
7. Chlorine Demand Test
8. Metal Oxidation Design Test
9. Filtration Design Calculations
10. Filtration Tests to Evaluation Removal Rates of Different Media Types
11. Microbial Disinfection Dose Optimization Test
12. Design of Activate Sludge Tank for Wastewater Treatment
13. Field Trip to Wastewater Treatment Plant
14. Term Project Presentations