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

MASTER SYLLABUS

COURSE NUMBER – COURSE NAME
CONS 387 – Water and Wastewater Treatment

Created by: Adrienne C. Rygel

Updated by: Adrienne C. Rygel

Canino School of Engineering Technology

Department: Civil and Construction Technology

Semester/Year: Fall 2018

A. **TITLE**: Water and Wastewater Treatment

B. **COURSE NUMBER:** CONS 387

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

 # Credit Hours: 3
 # Lecture Hours: 2 **per week**
 # Lab Hours: (1) three-hour lab **per week**
Other: **per week**

Course Length: 15 **Weeks**

D. **WRITING INTENSIVE COURSE**: Yes ☐ No ☒

E. **GER CATEGORY: None:** ☒ **Yes:** GER
***If course satisfies more than one*:** GER

F. **SEMESTER(S) OFFERED: Fall** ☐ **Spring** ☒ **Fall & Spring** ☐

G. **COURSE DESCRIPTION:**

The treatment of water is necessary to achieve the required quality necessary for a desired end-use. End-use may include, but is not limited to, drinking water, medical use, and industrial use. The treatment of wastewater streams is necessary to achieve an effluent stream suitable for disposal or possible additional processing for reuse. This course explores different chemical and physical methods of treatment for water and wastewater streams. Course content expands upon concepts learned in basic chemistry courses. Specific topics include the physical, chemical, and biological treatment processes of water and wastewater streams. Students learn design concepts and system operations for water and wastewater treatment plants. There is also a 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.

H. **PRE-REQUISITES: None** ☐ **Yes** ☒ **If yes, list below:**

College Chemistry I (CHEM 150) and MATH 161 (Calculus I), or permission of the instructor.

CO-REQUISITES: None ☒ **Yes** ☐ **If yes, list below:**

I. STUDENT LEARNING OUTCOMES: (*see key below*)

By the end of this course, the student will be able to:

Course Student Learning Outcome [SLO]	***Program Student Learning Outcome [PSLO]***	***GER*** *[If Applicable]*	***ISLO & SUBSETS***	
1. Explain significant standards and regulations in the water industry.	2488: 1a, 9ab, 10		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
2. Demonstrate knowledge of chemicals and methods used for coagulation and flocculation	2488: 1a, 2b, 4a		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
3. Indicate knowledge and application of different filtration methods	2488: 1a		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
4. Indicate knowledge and application of different types of disinfectants	2488: 1a, 2b		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
5. Determine chemical dosages based on the stoichiometrics of chemical reactions	2488: 2ab, 4b, 6b		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
6. Explain common biological wastewater treatment processes	2488: 1a		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets

7. Conduct basic laboratory tests for determinng appropriate chemical dosing for different water treatment components (eg. jar test for coagulation floccluation alum dosage; batch tests for chemical oxdation of inorganic contaminants; chlorine demand test for disinfection, Ct tests for bacteria disinfection)	2488: 1b, 2bc, 3abc, 5b		2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
8. 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)	2488: 1b, 2abc, 4ab		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
9. 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	2488: 7abcd, 8b, 9ab, 10, 11ad		1-Comm Skills ISLO ISLO	O W Subsets Subsets
.			ISLO ISLO ISLO	Subsets Subsets Subsets Subsets

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**

*Include program objectives if applicable. Please consult with Program Coordinator

J. APPLIED LEARNING COMPONENT: Yes ☒ No ☐

If YES, select one or more of the following categories:

- ☒ Classroom/Lab
- ☐ Internship
- ☐ Clinical Placement
- ☐ Practicum
- ☐ Service Learning
- ☐ Community Service
- ☐ Civic Engagement
- ☐ Creative Works/Senior Project
- ☐ Research
- ☐ Entrepreneurship (program, class, project)

K. TEXTS:

"Water and Wastewater Technology" by Mark J. Hammer and Mark J. Hammer Jr., Pearson Prentice Hall, 7th edition, 2008, ISBN 9780135114049.

L. REFERENCES:

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: None ☐ **Needed:** 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, safety gloves, deionized water
- pH probes and dissolved oxygen probes
- Turbidimeter
- Water sample filtration equipment
- Filter columns
- Microbial analysis equipment (e.g. agar plates, pipets, dilution tubes)
- Colorspectrophotometer and associated equipment/materials
- Jar Test Apparatus

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

- **Examinations,**
- **Laboratory exercises,**
- **Homework assignments,**
- **In-class exercises,**
- **Quizzes**
- **Term Project**

P. DETAILED COURSE OUTLINE:

I. Introduction
A. Water Quality Review

B. Basic Concepts of Water and Wastewater Treatment
1. Water treatment operations
2. Wastewater treatment operations
3. Review of reactors, flow, and detention time

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
a. Aerobic biological treatment
b. Anaerobic wastewater treatment

c. Treatment in ponds, land systems, and wetlands

E. Tertiary Treatment

F. Sludge processing and land application

G. Alternative Systems

Q. <u>LABORATORY OUTLINE</u>: None ☐ Yes ☒

1. Mass Balance and Reactor Lab
2. Water Quality Parameter Testing Review Lab #1
3. Water Quality Parameter Testing Review Lab #2
4. Coagulation and Flocculation Chemical Dosing Design Test
5. Flocculation Tank Design Calculations
6. Sedimentation Design
7. Sedimentation Calculations
8. Chlorine Demand Test
9. Metal Oxidation Design Test
10. Filtration Design Calculations
11. Filtration Tests
12. Microbial Disinfection Test
13. Field Trip to Wastewater Treatment Plant
14. Term Project Presentations