COURSE OUTLINE

CONS 387 – Water and Wastewater Treatment Technologies

Prepared By: Adrienne C. Rygel, Ph.D.
CONS 387 – Water and Wastewater Treatment Technologies

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

B. **COURSE NUMBER:** CONS 387

C. **CREDIT HOURS:** 3

D. **WRITING INTENSIVE COURSE:** No

E. **COURSE LENGTH:** 15 Weeks

F. **SEMESTER(S) OFFERED:** Spring

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:** 2, 50-minute lectures and 1, 3-hour lab

H. **CATALOG 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.

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

J. **GOALS (STUDENT LEARNING OUTCOMES):**

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

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<th>Course Objective</th>
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<td>1. Explain significant standards and regulations in the water industry.</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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<td>2. Demonstrate knowledge of chemicals and methods used for coagulation and flocculation</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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<td>3. Indicate knowledge and application of different filtration methods</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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<td>4. Indicate knowledge and application of different types of disinfectants</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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<td>5. Determine chemical dosages based on the stoichiometrics of chemical reactions</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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| 6. | Explain common biological wastewater treatment processes | 2. Critical Thinking  
3. Professional Competence |
| 7. | Conduct a chlorine demand test | 2. Critical Thinking  
3. Professional Competence |
| 8. | Conduct/analyze data from a ct test for disinfection of heterotrophic bacteria | 2. Critical Thinking  
3. Professional Competence |
| 9. | Conduct basic laboratory tests for determining appropriate chemical dosing for oxidation of inorganic contaminants | 2. Critical Thinking  
3. Professional Competence |
| 10. | Conduct a jar test to determine optimal coagulant dosages for the greatest log removal of suspended particulate matter. | 2. Critical Thinking  
3. Professional Competence |
| 11. | 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) | 2. Critical Thinking  
3. Professional Competence |
| 12. | 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. | 1. Communication  
2. Critical Thinking  
3. Professional Competence  
4. Inter/ Intrapersonal Skills |

K. **TEXTS:**

L. **REFERENCES:** none

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, 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. **MEASUREMENT CRITERIA/METHODS:**
- Examinations,
- Laboratory exercises,
- Homework assignments,
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. LABORATORY OUTLINE:

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