**WWTR 122 Course Outline as of Fall 2023**

# CATALOG INFORMATION

Dept and Nbr: WWTR 122 Title: CHEM FOR WATER TECH
Full Title: Chemistry for Water and Wastewater Technology
Last Reviewed: 2/13/2023

| Units | | Course Hours per Week | | Nbr of Weeks | Course Hours Total | |
|---|---|---|---|---|---|---|
| Maximum | 3.00 | Lecture Scheduled | 2.00 | 17.5 | Lecture Scheduled | 35.00 |
| Minimum | 3.00 | Lab Scheduled | 3.00 | 6 | Lab Scheduled | 52.50 |
| | | Contact DHR | 0 | | Contact DHR | 0 |
| | | Contact Total | 5.00 | | Contact Total | 87.50 |
| | | Non-contact DHR | 0 | | Non-contact DHR | 0 |

Total Out of Class Hours: 70.00 Total Student Learning Hours: 157.50

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| Title 5 Category: | AA Degree Applicable |
| Grading: | Grade or P/NP |
| Repeatability: | 00 - Two Repeats if Grade was D, F, NC, or NP |
| Also Listed As: | |
| Formerly: | ENVT 122 |

**Catalog Description:**
In this course students will gain a basic understanding of wastewater laboratory information, including chemical terms and symbols, equipment, sampling, safety, and quality assurance. Students will perform lab tests, including pH, dissolved oxygen, solids (settleable, suspended, total, volatile), sludge volume index, biological and chemical oxygen demand, alkalinity, hardness, turbidity, chlorine residual, and total coliform bacteria.

**Prerequisites/Corequisites:**
Course Completion of WWTR 112 ( or ENVT 112)

**Recommended Preparation:**

**Limits on Enrollment:**

**Schedule of Classes Information:**
Description: In this course students will gain a basic understanding of wastewater laboratory information, including chemical terms and symbols, equipment, sampling, safety, and quality assurance. Students will perform lab tests, including pH, dissolved oxygen, solids (settleable, suspended, total, volatile), sludge volume index, biological and chemical oxygen demand,

alkalinity, hardness, turbidity, chlorine residual, and total coliform bacteria. (Grade or P/NP)
Prerequisites/Corequisites: Course Completion of WWTR 112 ( or ENVT 112)
Recommended:
Limits on Enrollment:
Transfer Credit:
Repeatability: Two Repeats if Grade was D, F, NC, or NP

## ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

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|---|---|---|---|
| **AS Degree:** | **Area** | Effective: | Inactive: |
| **CSU GE:** | **Transfer Area** | Effective: | Inactive: |
| **IGETC:** | **Transfer Area** | Effective: | Inactive: |

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| **CSU Transfer:** | Effective: | Inactive: |
| **UC Transfer:** | Effective: | Inactive: |

**CID:**

**Certificate/Major Applicable:**
Both Certificate and Major Applicable

## COURSE CONTENT

**Student Learning Outcomes:**
At the conclusion of this course, the student should be able to:
1. Implement quality assurance and safety procedures while performing chemical and biological tests used in water/wastewater testing laboratories.
2. Apply chemical and biological concepts when performing laboratory tests.
3. Make necessary mathematical calculations required in water/wastewater laboratory testing.

**Objectives:**
At the conclusion of this course, the student should be able to:
1. Apply an understanding of basic water and wastewater chemistry to treatment processes.
2. Demonstrate safe use and proper care of laboratory equipment.
3. Define and identify types of samples collected for water and wastewater testing processes.
4. Analyze and determine if proper levels of water and wastewater treatment have been achieved.
5. Perform laboratory tests for pH, dissolved oxygen, solids (settleable, suspended, total, and volatile), sludge volume index, biological oxygen demand, chemical oxygen demand, alkalinity, hardness, turbidity, jar testing, free and total chlorine residual, total suspended solids, and mixed liquor suspended solids.

**Topics and Scope:**

I. Introduction
   A. Laboratory safety
   B. Use of emergency equipment
   C. Techniques for handling toxic or dangerous chemicals
   D. Right-to-Know information: manufacturer chemical reagent safety data sheets (SDS)

- E. Care and use of analytical instrumentation
- F. Measurements in chemistry
- G. Mathematical calculations for the laboratory

II. General Chemistry
- A. Matter and energy
- B. Elements and the periodic table
- C. Compounds with sulphur, nitrogen, chlorine, and fluorine
- D. Chemical equations
- E. Chemical solutions and dilutions
- F. Acid, bases, and salts

III. Chemical Analysis Methods
- A. Colorimetry
- B. Acid-base titrations
- C. Argentometric titrations
- D. pH electrodes use
- E. Methylene blue testing
- F. Conductivity testing
- G. Hardness: calcium and magnesium

IV. Colloids and Coagulation
- A. Turbidity and turbidimetric testing
- B. Coagulant dosing
- C. Filterability index
- D. Jar testing

V. Corrosion
- A. Marble test
- B. Langelier saturation index
- C. Ryzner index
- D. Coupon testing

VI. Coliform Testing Methods
- A. Presence/absence tests
- B. Heterotrophic Plate Counts (HPC) test
- C. Multiple tube fermentations
- D. Amperometric and Iodometric titrations
- E. Free and total chlorine
- F. Chlorine demand and the chloramination curve
- G. Membrane filtration
- H. Other chemical and physical disinfectant methods

VII. Metals Issues and Testing
- A. Toxicity effects
- B. Contamination sources and pathways
- C. Testing methods
- D. Regulatory requirements

VIII. Solids and Sludge Control
- A. Sludge analysis
- B. Mean Cell Residence Time (MCRT) calculation
- C. Sludge settleables cylinder method
- D. Food to Microorganism (F/M) ratio calculation
- E. Digester sludge (Volatile Acidity) distillation method

IX. Digestion Processes
- A. Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD)
- B. Organic chemistry overview
- C. Types of organic compounds: hydrocarbons, carbohydrates, lipids, and proteins

D. Total Organic Carbon (TOC)

The course integrates laboratory and lecture topics.

**Assignment:**

Lecture-Related Assignments:
1. Reading (10-30 pages per week)
2. Problem solving homework (4-7 sets)
3. Quiz(zes) (0-14) and/or exam(s) (0-2)
4. Final Exam

Lab-Related Assignments:
1. Laboratory activities with notebook or reports (12-15)

**Methods of Evaluation/Basis of Grade:**

**Writing:** Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

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| None, This is a degree applicable course but assessment tools based on writing are not included because problem solving assessments are more appropriate for this course. | Writing<br>0 - 0% |

**Problem Solving:** Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

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| Homework problems | Problem solving<br>10 - 30% |

**Skill Demonstrations:** All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

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| None | Skill Demonstrations<br>0 - 0% |

**Exams:** All forms of formal testing, other than skill performance exams.

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| Quizzes and/or exams; final exam | Exams<br>40 - 55% |

**Other:** Includes any assessment tools that do not logically fit into the above categories.

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| Laboratory activities with notebook or reports | Other Category<br>20 - 40% |

**Representative Textbooks and Materials:**
Basic Chemistry for Water and Wastewater Operators. Sarai, Darshan. American Water Works Association. 2005 (classic)
Instructor prepared materials