

WWTR 112 Course Outline as of Fall 2012**CATALOG INFORMATION**

Dept and Nbr: WWTR 112 Title: WASTEWATER TREATMNT MATH

Full Title: Wastewater Treatment Math

Last Reviewed: 2/13/2023

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

Total Out of Class Hours: 105.00

Total Student Learning Hours: 157.50

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 112

Catalog Description:

Practical application of mathematical calculations for hydraulics, chemicals, and solids used in the design, operation, process control and maintenance of wastewater treatment plants and facilities.

Prerequisites/Corequisites:**Recommended Preparation:****Limits on Enrollment:****Schedule of Classes Information:**

Description: Practical application of mathematical calculations for hydraulics, chemicals, and solids used in the design, operation, process control and maintenance of wastewater treatment plants and facilities. (Grade or P/NP)

Prerequisites/Corequisites:

Recommended:

Limits on Enrollment:

Transfer Credit:

Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

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

CID:

Certificate/Major Applicable:

Both Certificate and Major Applicable

COURSE CONTENT

Outcomes and Objectives:

Upon completion of the course, students will be able to:

1. Apply general mathematical concepts to the wastewater industry.
2. Utilize special terminology and units as applied to wastewater science operations.
3. Utilize basic mathematical principles for hydraulic calculations.
4. Explain the basics of pump usage and operation.
5. Utilize unit conversions related to flow, volume, and weight.
6. Analyze and calculate the necessary parameters used in the operation, process control and maintenance of a wastewater treatment plant.

Topics and Scope:

I. Mathematical methods for hydraulic calculations

- A. Fractions, decimals, percentages
- B. Arithmetic mean, median, mode
- C. Weighted averages
- D. pH calculations
- E. Ratio and proportions
- F. Conversions

1. English to metric
2. Volume to weight
3. Flow conversions

G. Algebraic concepts for variable isolation

II. Calculations of chemical quantities

- A. Pounds required
- B. Dose calculations
- C. Preparation of chemical solutions

III. Wastewater collection

- A. Flow quantity
1. Average flow

- 2. Per capita flow
- 3. Equivalent population for industrial discharges
- B. Flow composition
- C. Flow velocity
- IV. Preliminary treatment
 - A. Pumping stations
 - 1. Wet well capacity
 - 2. Wet well pumping rate
 - B. Screenings
 - C. Grit chambers and sand traps
 - 1. Flow velocity
 - 2. Detention time
 - 3. Grit removal
- V. Primary treatment: wastewater
 - A. Influent loading: Biological Oxygen Demand (BOD), Total Dissolved Solids (TDS)
 - B. Clarifier/sedimentation basin volume
 - C. Surface loading rate
 - D. Clarifier detention time
 - E. Weir overflow rate
 - F. Clarifier efficiency
 - G. Solids removal
 - H. Clarifier sludge pumping
- VI. Treatment: ponds and filters
 - A. Stabilization ponds
 - 1. Volume
 - 2. Loading: hydraulic and organic
 - 3. Evaporation rate
 - B. Trickling filters
 - 1. Filter capacity
 - 2. Loading: hydraulic and organic
 - 3. Treatment efficiencies- BOD & suspended solids
 - 4. Recirculation ratio
- VII. Activated sludge treatment of wastewater
 - A. Aeration
 - 1. Food/micro-organism loading ratio
 - 2. Mean cell residence time
 - 3. Waste sludge pumping rate
 - 4. Return activated sludge pumping rate
 - 5. Aerator air requirements
 - B. Secondary clarification loading rates
 - 1. Rate calculations
 - 2. Sludge volume index
- VIII. Advanced treatment: wastewater
 - A. Filtration rate
 - B. Chemical addition requirements
- IX. Sludge treatment and disposal for wastewater treatment
 - A. Sludge pumping: wastewater
 - 1. Sludge volume
 - 2. Sludge thickening
 - 3. Piston pumps
 - B. Digester seeding
 - C. Digester loading & detention time

- D. Volatile acids/alkalinity ratio
- E. Volatile solids reduction
- F. Sludge withdrawal for dewatering
- X. Mechanical solids thickening
 - A. Centrifuge efficiency
 - B. Belt press efficiency
 - C. Dissolved air flotation: solids capture and air to solids ratio
 - D. Other solids thickening
- XI. Effluent treatment and disposal
 - A. Disinfection
 - 1. Chlorine dosage, demand, and residual
 - 2. Hypochlorite calculations
 - 3. Calculation of CT(concentration x time)
 - 4. Dechlorination
 - 5. Other disinfection methods
 - B. Log removal calculations to assess disinfection efficiency
 - C. Sand filtration
- XII. Solids balance through wastewater treatment plants
 - A. Calculation methods for solids in pounds and sludge units
 - B. Process used to determine solids mass and location
 - C. Values used to determine solids mass balance
- XIII. Pumps
 - A. Head
 - 1. Static
 - 2. Friction
 - 3. Total dynamic
 - 4. Head loss
 - B. Power usage
 - 1. Horsepower
 - 2. Brake horsepower
 - 3. Motor horsepower
 - 4. Conversion of horsepower to kilowatt
 - 5. Cost of power

Assignment:

- 1. Weekly problem solving homework assignments related to wastewater treatment
- 2. Quizzes (10-15)
- 3. Final exam

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.

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
0 - 0%

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

Homework problems

Problem solving
40 - 60%

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

None

Skill Demonstrations
0 - 0%

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

Quizzes; final exam (multiple choice, short answer, true-false and problem solving)

Exams
40 - 60%

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

Attendance and class participation.

Other Category
0 - 10%

Representative Textbooks and Materials:

1. Math Text for Water & Wastewater Technicians, 3rd edition. Grover Wright. Wright's Training, 1997 (classic).
2. Applied Math for Wastewater. Joanne Kilpatrick Price. First CRC Press, 1991 (classic).
3. Applied Math for Wastewater Workbook. Joanne Kilpatrick Price. First CRC Press, 1991 (classic).
4. Instructor prepared materials