

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

Center for Water Studies 102 – Calculations in Water & Wastewater

3 hours lecture, 3 units

Catalog Description

Study of the mathematical principles and methods involved in solving problems related to water and wastewater treatment, distribution, and collection systems, including volume, flow rate, velocity, pressure, force, unit conversions, dimensional analysis, chemical dose rates, dilutions, filter loading and backwash rates as related to water/wastewater technology.

Prerequisite

None

Recommended Preparation

Competency in basic math skills

Entrance Skills

Without the following skills, competencies and/or knowledge, students entering this course will be highly unlikely to succeed:

- 1) Computing and simplifying using basic algebraic operations and square roots
- 2) Solving linear equations with one or two variables
- 3) Solving word problems and applications:
 - a. Translation of verbal expressions into algebraic expressions
 - b. Numerical and measurement problems
- 4) Use charts, tables, and formulas to solve unknowns relating to pressure, volume, flow rates, velocities, dilution rates, and chemical dosage.

Course Content

- 1) Basic arithmetic and algebra review
- 2) Basic units and algebraic formulas
- 3) Area and volume measurements
- 4) Rounding, percentages, scientific notation
- 5) Methods for problem solving in water and wastewater applications
- 6) Solving for the unknown, unit conversions, dimensional analysis
- 7) Flow, velocity, hydrostatic force, hydraulics, head loss, HGL
- 8) Ratios and proportions
- 9) Determining detention and retention time
- 10) Density and specific gravity
- 11) Filter rates, backwash rates, surface loading rates
- 12) Chemical dosages and concentrations
- 13) Pumping calculations, horsepower, pump efficiency, pumping cost, pump curves
- 14) Averages, GPCD, peak factors

Course Objectives

Students will be able to:

- 1) Understand basic units and the use of algebraic formulas.
- 2) Calculate areas and volumes of fundamental geometric shapes.
- 3) Perform rounding, calculate percentages, and work in scientific notation.

- 4) Understand the methods used for problem solving in water and wastewater applications.
- 5) Perform calculations relating to flow, velocity, hydrostatic force, hydraulics, head loss, and HGL.
- 6) Calculate ratios and proportions.
- 7) Determine detention and retention time.
- 8) Calculate density and specific gravity.
- 9) Compute filter rates, backwash rates, and surface loading rates.
- 10) Calculate chemical dosages and concentrations.
- 11) Perform calculations for pumping, horsepower, pump efficiency, pumping cost, and pump curves.
- 12) Compute averages, GPCD, and peak factors.

Method of Evaluation

A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in subject matter determined by multiple measurements for evaluation, one of which must be essay exams, skills demonstration or, where appropriate, the symbol system.

- 1) Quizzes, homework, and exams that measure students' ability to:
 - a. Evaluate, analyze, and solve problems related to water and wastewater treatment, delivery and collection.
 - b. Interpret and utilize graphs, tables and formulas in the calculation of various mathematical problems commonly encountered in water and wastewater treatment, delivery, and collection.
- 2) Exercises and assignments that demonstrate students' ability to use formulas, charts, graphs and tables to solve problems common to the water and wastewater industry.
- 3) Projects and assignments utilizing the Field Operations Skills Yard.

Special Materials Required of Student

None

Minimum Instructional Facilities

Smart classroom

Method of Instruction

- 1) Lecture and discussion
- 2) Multimedia presentations
- 3) Demonstration of problem-solving techniques
- 4) Demonstrations utilizing the Field Operation Skills Yard

Out-of-Class Assignments

- 1) **Reading:** Read selected textbook sections on units, formulas, dimensional analysis, and water/wastewater calculation methods; review charts, tables, and graphs used in flow, velocity, hydraulics, and chemical dosage calculations.
- 2) **Writing:** Complete written solutions to math problem sets involving unit conversions, flow/velocity calculations, chemical dosage, ratios/proportions, and pumping calculations; prepare written summaries interpreting data from graphs, tables, or operator worksheets.
- 3) **Other:** Projects or presentations; prepare for quizzes and exams by completing additional practice problems;

Texts and References

- 1) Required (representative example): Pizzi, Nicholas. *Basic Science Concepts and Applications*. 4th edition. American Water Works Association, 2010 (Classic).
- 2) Supplemental: Giorgi, John. *Math for Distribution System Operators*. American Water Works Association, 2007.

Exit Skills

Students having successfully completed this course exit with the following skills, competencies and/or knowledge:

- 1) Perform dimensional analysis and solve problems related to water and wastewater treatment, delivery and collection.
- 2) Interpret and utilize graphs, tables and formulas in the calculation of various mathematical problems commonly encountered in the water and wastewater industry.
- 3) Ability to translate verbal expressions into the appropriate algebraic expressions and formulas necessary to solve problems commonly encountered in water & wastewater treatment, delivery and collection.

Student Learning Outcomes

Upon successful completion of this course, students will be able to:

- 1) Perform mathematical calculations to solve problems common to water/wastewater distribution, collection, and treatment systems.
- 2) Determine the appropriate methods and formulas necessary to solve problems relating to pressure, volume, flow rate, velocities, dilution rates, and chemical dosages.
- 3) Use charts, tables, and formulas to solve unknowns relating to pressure, volume, flow rates, velocities, dilution rates, and chemical dosage.
- 4) Perform conversions and dimensional analysis necessary to solve problems relating to pressure, volume, flow rates, velocities, dilution rates, and chemical dosages.