

Course Title: Math Applications in Water Treatment

Course Hours: 21 (2.1 CEUs)

Course Description:

This course focuses on math concepts related to water treatment plant operation and applies these concepts to work-related math problems. Operators practice solving math problems while getting step-by-step instructions. This course covers topics that operators encounter on the job. It does not attempt to cover the topics of any state certification exam.

Course Objectives:

Upon completion of this course, participants will be able to perform math calculations typically used in water treatment plant operation. Course objectives include:

- Solve problems related to calculating the flow rate, dose, and feed rate of chemicals
- Calculate acre-feet as a unit for volume
- Calculate needed doses for algae control
- Calculate the amount of liquid polymer needed to achieve a desired dose
- Estimate the needed alum dose
- Calculate needed doses based on chemical strength
- Calculate the detention time of a flash mixer and flocculation tank
- Estimate the needed lime dose for alkalinity adjustment
- Calculate the surface loading of a clarifier
- Calculate weir loading rate
- Estimate the flow rate through a filter
- Estimate unit filter run volume
- Estimate backwash volume
- Estimate chlorine dose, demand, and residual
- Estimate the needed chlorine amount based on a given strength of chlorine solution
- Apply the concept of breakpoint chlorination and decide whether the chlorination in a water is beyond breakpoint
- Determine whether the water in a system is corrosive
- Estimate average chlorine usage per day based on collected data
- Estimate how long a stored amount of chlorine will last on average, in days
- Convert units from metric to US customary and be familiar with the relationship between comparable units in each system
- Convert temperature from degrees Celsius to degrees Fahrenheit
- Calculate molarity and normality in relation to calculating alkalinity
- Use titration information to calculate the three components of alkalinity
- Calculate most probable number

Course Outline:

- 1) Basic Math Concepts (250 minutes)
 - a. Numbers and Operations
 - b. Order of Operations
 - c. Basic Algebra
 - d. Percentages
- 2) Intermediate Math Concepts (290 minutes)
 - a. Units
 - b. Area
 - c. Volume
 - d. Mass and Weight
 - e. Density and Specific Weight
 - f. Concentration
 - g. Velocity and Flow Rate
 - h. Force and Pressure
 - i. Work, Head, and Power
 - j. Metric System
- 3) Advanced Math Concepts (320 minutes)
 - a. Pumps
 - b. Evaluating Pump Performance
 - c. Analyzing and Presenting Data
 - d. Describing Data or Results
 - e. Moving Averages
 - f. More Applications of Graphing and Charting
 - g. Regression Analysis (Prediction Equations, Trends, and Correlations)
- 4) Overview of Math Applications in Water Treatment (10 minutes)
 - a. Introduction
 - b. Watch 1 course video
- 5) Basic Concepts (20 minutes)
 - a. Measure flow rate
 - b. Dose and mass rate
 - c. Work through example problems 1–2
- 6) Reservoir Management (20 minutes)
 - a. Learn about acre-feet
 - b. Work through example problems 1–5
- 7) Coagulation and Flocculation (30 minutes)
 - a. Watch 1 course video
 - b. Work through example problems 1–6
- 8) Sedimentation (35 minutes)
 - a. Watch 1 course video
 - b. Work through example problems 1–9
- 9) Filtration (35 minutes)
 - a. Watch 1 course video
 - b. Learn about conventional filtration
 - c. Work through example problems 1–6

- 10) Disinfection (30 minutes)
 - a. Learn about disinfection
 - b. Complete example problems 1–7
- 11) Corrosion (15 minutes)
 - a. Learn about corrosion and how it occurs
 - b. Learn about the Langelier Index
 - c. Work through example problem 1
- 12) Plant Operation (10 minutes)
 - a. Learn about basic concepts related to operating a water treatment plant
 - b. Work through example problems 1–2
- 13) Laboratory Procedures (80 minutes)
 - a. Learn about units and unit conversions
 - b. Work through example problem 1–5
 - c. Learn about molar concentration (molarity)
 - d. Work through example problems 6–7
 - e. Learn about normal concentrations (normality)
 - f. Work through example problem 8
 - g. Learn about alkalinity
 - h. Work through example problems 9–11
 - i. Learn about most probable number
 - j. Work through example problems 12–15
- 14) Final Exam (120 minutes)

Course Format: This course will be delivered online.

Assessment Methodology: Cumulative online assessment (final exam, 120 minutes)

Prerequisites: None

Textbook: None

Recommended Reading: “Water Treatment Plant Operation,” Volume 1, Seventh Edition.
Office of Water Programs, www.owp.csus.edu