Online  owp.csus.edu

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Sacramento, CA 95819

Monday–Friday
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Payment Options
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Mail
Office of Water Programs
California State University, Sacramento
6000 J Street, Modoc Hall 1001, MS 6025
Sacramento, CA 95819

Fax  916. 278. 5959

Email  wateroffice@owp.csus.edu

Return/Cancellation Policy
See our full return policy at www.owp.csus.edu/policy/return.php. Returns must be preapproved by OWP and received within 14 days of the purchase date (other conditions apply). Course enrollments may be canceled and refunded within 5 days of the purchase date (other conditions apply).

Features
• Chapter review sections
• Expanded explanations of math concepts and step-by-step example problems
• Updated, full-color photos and illustrations
• Includes 6 months of eText access with manual purchase

Prices subject to change without notice.
Check pricing at owp.csus.edu
When enrolling in a course, you will receive information about the time limit for completing the course. Each manual, online course, or video is a separate course. If you enroll in more than one course at the same time, the time limits apply to each course separately and begin at the time of enrollment.
Instructor guides for water series courses available for $35 to qualified instructors. Call for ordering information.

Water Treatment Plant Operation
Vol 1, Seventh Edition

Courses train operators to safely and effectively operate and maintain drinking water treatment plants.

Manual
$100 (Includes eText)

Enrollment
$75 (9 CEUs)

1 Introduction to Water Treatment
2 Source Water, Reservoir Management, and Intake Structures
3 Coagulation and Flocculation
4 Sedimentation
5 Filtration
6 Disinfection
7 Corrosion Control
8 Taste and Odor Control
9 Laboratory Procedures

Appendix A: Introduction to Basic Math for Operators
Answer Key, Glossary, Index

Prices subject to change without notice.
Check pricing at owp.csus.edu

Water Treatment Plant Operation
Vol 2, Seventh Edition

Course provides operators with the knowledge and skills to properly install, inspect, operate, maintain, and manage water treatment plant systems.

Manual
$100 (Includes eText)

Enrollment
$75 (9 CEUs)

1 Producing Safe Water in a Safe Workplace
2 Softening
3 Specialized Treatment Processes
4 Fluoridation
5 Membrane Treatment Processes
6 Process Wastes
7 Instrumentation and Control Systems
8 Plant Maintenance
9 Management

Appendix A: Introduction to Basic Math for Operators
Answer Key, Glossary, Index

Prices subject to change without notice.
Check pricing at owp.csus.edu

eLearning math course available!
See page 44
Water Distribution System Operation and Maintenance

Seventh Edition

This course trains operators to safely and effectively operate and maintain drinking water distribution systems.

Water Distribution System eLearning Courses

eLearning courses feature guided reading assignments, self-assessment questions to help you check your understanding, interactive exercises, video clips, and online resources. The related training manual, *Water Distribution System Operation and Maintenance, Seventh Edition*, is sold separately.

**Online Enrollment — $100 each (1.8 CEUs per course)**

- **703A Safety**
  Topics include operator responsibilities; safety programs; safe operation and maintenance of pumps, wells, vehicles, and equipment; traffic routing; working in streets; protecting the public; and conducting waterworks safety inspections.

- **703B Distribution Facilities**
  Topics include facility types, purposes, and locations; inspections; troubleshooting; disinfection; corrosion protection; system hydraulics; meters; backflow prevention devices; and recordkeeping.

- **703C Disinfection**
  Topics include disinfecting wells, pumps, mains, and storage facilities; operating and maintaining hypochlorinators and chlorinators; troubleshooting chlorination systems; and conducting a chlorine safety program.

- **703D Operation & Maintenance**
  Topics include safe operation and maintenance; system surveillance, water quality monitoring, and cross-connection control programs; locating buried pipes and repairing leaks; pipe connections; pipe flushing and cleaning; thawing frozen pipes and hydrants; meter testing; disinfecting mains and storage facilities; recordkeeping; and emergency response.

- **703E Management**
  Topics include emergency planning; developing an organization chart; writing job descriptions and interview questions; conducting employee evaluations; ensuring equal and fair treatment to employees; financial planning; setting up a safety program; and records management.

**Manual**

- **$100 (Includes eText)**

**Enrollment**

- **$75 (9 CEUs)**

*Instructor guides for water series courses available for $35 to qualified instructors. Call for ordering information.*


---

1 Introduction to Water Distribution
2 Water Storage Facilities
3 Distribution System Facilities
4 Operation and Maintenance
5 Disinfection
6 Safety
7 Management

Appendix A: Introduction to Basic Math for Operators
Answer Key, Glossary, Index
Small Water System Operation and Maintenance
Sixth Edition

This course is designed to train operators in the safe and effective operation and maintenance of small water systems and treatment plants. Materials focus on wells, pumps, disinfection, and small water treatment plants serving populations of fewer than 10,000.

Small Water Systems eLearning Courses

eLearning courses feature guided reading assignments, self-assessment questions to help you check your understanding, interactive exercises, video clips, and online resources. The related training manual, Small Water System Operation and Maintenance, Sixth Edition, is sold separately.

Online Enrollment — $100 each (1.8 CEUs per course)

702A Wells
Topics include wellhead protection; well and pump system components; maintenance; pump and tank operation; inspection; disinfection; recordkeeping; sand removal; troubleshooting; site selection; evaluation and testing; drilling methods; and well plugging.

702B Treatment Plants
Topics include treatment requirements and methods for surface and groundwaters; coagulation; flocculation; sedimentation; filtration; disinfection; corrosion control; solids-contact clarification; sand filters; mineral removal; maintenance; and safety.

702C Disinfection
Topics include water supply system components; hydrologic cycle; sanitary survey methods; regulations; effectiveness; physical and chemical methods; applicability of disinfection to various types of equipment; chlorination rates; chlorine residual measurement; safety; and applied math solution techniques.

702D Safety
Topics include safety program implementation; equipment use; safe practices; lockout/tagout procedures; inspections; and water rate determination, calculation, and administration.

702E Laboratory Procedures
Topics include operator responsibilities; certification requirements; basic laboratory analysis procedures and equipment; sampling techniques and devices; tests (alkalinity, hardness, coliform bacteria counts, jar tests, and others); and applied math problems and solutions.

Manual
$100 (Includes eText)

Enrollment
$75 (9 CEUs)

Prices subject to change without notice. Check pricing at owp.csus.edu

Instructor guides for water series courses available for $35 to qualified instructors. Call for ordering information.
Small Water Systems Video Information Series

This 10-topic DVD (20 to 60 minutes each) is designed to serve the needs of operators, managers, owners, and elected board members of small water systems. The material focuses on the basic operation and maintenance of small groundwater and surface water supply systems and water distribution systems.

Course Package (enrollment, DVD set, and learning booklet)—$175
DVD Set (with learning booklet)—$100
Enrollment—$75 (3 CEUs)
Supplemental Learning Booklet—$49

Prices subject to change without notice. Check pricing at owp.csus.edu

Video Topics
- Roles and Responsibilities of Operators, Managers, Owners, and Elected Board Members
- Surface Water Treatment, Part 1
- Surface Water Treatment, Part 2
- Groundwater Treatment, Part 1
- Groundwater Treatment, Part 2
- Storage and Distribution
- Monitoring
- Managerial Responsibilities
- Financial Considerations
- Emergency Preparedness

Water Systems Operation and Maintenance Video Training Series

This 7-topic DVD presents instruction from working operators, engineers, and managers who are experts in their fields and features operators performing duties at their facilities.

Course Package (enrollment, DVD set, and learning booklet)—$175
DVD Set (with learning booklet)—$100
Enrollment—$75 (3 CEUs)
Supplemental Learning Booklet—$49

Prices subject to change without notice. Check pricing at owp.csus.edu

Video Topics
- Wellhead Protection
- Hypochlorination
- Water Storage Tanks
- Sampling and Testing
- Inspecting a Pump Station
- Distribution Systems
- Approaches to Compliance with Standards

Published by Kenneth D. Kerri, Ph.D.
Funded by the US Environmental Protection Agency Office of Ground Water and Drinking Water
Produced by Greenelsh Productions
© 2000, Office of Water Programs
Basic Small Water System Operations

Water supply systems vary among towns, cities, and regions. This manual serves as a resource book for small water systems, providing an overview of the basic operation and maintenance of these systems.

This manual can be used to prepare for further study and a career in the operation and maintenance of water treatment and distribution facilities.

If used in conjunction with a test administered by the California State Water Resources Control Board, the manual can also be used to satisfy the high school diploma requirement for admittance into the California drinking water certified operator examinations.

For more information about this opportunity, call (916) 449-5642 or email dwopcertprogram@waterboards.ca.gov.

Manual — $30

1. Roles and Responsibilities of Operators
2. Sources of Water
3. Wells
4. Small Water Treatment Plants
5. Water Storage and Distribution
6. Drinking Water Laws and Regulations
7. Math for Small Water System Operators

Appendix: Practice Test and Suggested Answers, Words, Index
Improving Learning Pathways and Options

To offer students a clearer learning pathway that mirrors the experience of many operators as they progress in their careers from operator-in-training to lead operator to utility manager, OWP substantially revised the popular Operation of Wastewater Treatment Plants series. The series is now 3 volumes and highlights different aspects of wastewater treatment:

- **Volume 1** covers treatment of liquids, including preliminary, primary, and secondary treatment, as well as disinfection and laboratory procedures.
- **Volume 2** presents information on nutrient removal, treatment and handling of solids, and plant maintenance.
- **Volume 3** discusses effluent discharge and reuse as well as plant-wide processes and procedures, such as odor control, instrumentation, and utility management.

We also created multiple, shorter correspondence courses with fewer continuing education units (CEUs) based on selected chapters from each volume. The new courses offer operators a stepwise approach to obtaining or maintaining professional certifications, as well as the opportunity to focus their learning on the topics most applicable to their jobs or aspirations.

An operator-in-training can take “Volume 1, Course A—Safety, Beginning Treatment, and Lagoon Systems” as part of their entry-level certification and learn to run preliminary and primary treatment processes. Alternately, a more experienced operator who is applying to become an activated sludge process specialist can start with “Volume 1, Course B—Secondary Treatment,” which covers that treatment process in detail.

More information about all 3 volumes and their associated courses appears on pages 20, 22, and 23.

Look for multiple courses for most new editions of OWP training manuals.

More information at: owp.csus.edu/courses/wastewater.php
Operation of Wastewater Treatment Plants

Vol 1, Eighth Edition

Courses are designed to train operators in the safe and effective operation and maintenance of wastewater treatment plants. Volume 1 focuses on treatment methods for liquid wastes and how to analyze and solve operational problems.

Central to the operation of a wastewater treatment plant is a good understanding of the processes involved and the ability to perform basic math and science. All of these topics are covered in this comprehensive training manual that begins with the fundamentals of operation and maintenance of wastewater treatment facilities, progressing to the more advanced aspects of wastewater treatment.

Preliminary and Primary Treatment
This course provides an introduction to wastewater treatment operation and maintenance and to the facilities that treat wastewater. It also provides in-depth discussion of preliminary and primary wastewater treatment facility operation and maintenance.

Activated Sludge 1
This course focuses on activated sludge systems in normal operations, including process description, control strategies and procedures, and performance monitoring.

Activated Sludge 2
This course focuses on less common activated sludge process operations, including causes and symptoms of abnormal operation, troubleshooting, and startup and shutdown. Equipment maintenance topics are also covered.

Fixed Film Processes
This course covers operation and maintenance of fixed film biological wastewater treatment processes. Facility types covered include trickling filters and rotating biological contactors. Topics covered include operational theory, startup and shutdown, operational strategy, loading criteria, and system sampling and monitoring.

Disinfection
This course covers operation and maintenance of disinfection treatment processes with an emphasis on chlorination systems. All common types of chlorination systems are included, along with operation and maintenance of dechlorination systems. Other disinfection processes covered include ultraviolet and ozone treatment.

Lagoon Systems
This course covers the classifications and applications of lagoon systems as well as their operation and maintenance and troubleshooting and sampling procedures.
Operation of Wastewater Treatment Plants
Vol 2, Eighth Edition

Courses are designed to train operators in the safe and effective operation and maintenance of wastewater treatment plants. Volume 2 focuses on treating, handling, and disposing of solids in wastewater.

Manual—$100 (Includes eText)

Enrollment A—$40 (3.5 CEUs)
Treatment Plants and Tertiary Treatment

Enrollment B—$40 (4 CEUs)
Solids Management and Plant Maintenance

1 Introduction to Wastewater Treatment
2 Nutrient Removal (Tertiary Treatment)
3 Solids Removal from Effluent (Tertiary Treatment)
4 Residual Solids Management
5 Plant Maintenance

Appendix A: Introduction to Basic Math for Operators
Answer Key, Glossary, Index

Instructor guides for wastewater series courses available for $35 to qualified instructors. Call for ordering information.

Operation of Wastewater Treatment Plants
Vol 3, First Edition

This manual replaces Advanced Water Treatment. Courses are designed to train operators in the safe and effective operation and maintenance of wastewater treatment plants. Volume 3 focuses on effluent discharge and reuse, odor control, instrumentation, and utility management.

Manual—$100 (Includes eText)

Enrollment A—$40 (2.3 CEUs)
Introduction, Effluent Discharge and Reuse, and Odor Control

Enrollment B—$40 (3.5 CEUs)
Instrumentation and Utility Management

1 Introduction to Wastewater Treatment
2 Effluent Discharge and Reuse
3 Odor Control
4 Instrumentation and Control
5 Introduction to Wastewater Utility Management

Appendix A: Introduction to Basic Math for Operators
Answer Key, Glossary, Index

eLearning math course available!
See page 45
Advanced Waste Treatment
Fifth Edition

This course is part of the Operation of Wastewater Treatment Plants series, covering biological, physical, chemical, and advanced waste treatment processes.

Membrane Bioreactors
First Edition

This course describes the membrane bioreactor (MBR) wastewater treatment process; explains how to operate, maintain, and troubleshoot the process; stresses safe procedures for cost-effective O&M; and helps operators develop strategies to correct MBR failures. Procedures are provided for implementing a comprehensive startup, commissioning, and training phase prior to the complete transfer of an MBR plant to the O&M staff.
Operation and Maintenance of Wastewater Collection Systems
Vol 1, Eighth Edition

These courses are designed to train new and current operators in the safe and effective operation and maintenance of wastewater collection systems. Volume 1 focuses on tasks performed by line maintenance crews and covers various types of collection systems and construction inspection.

Manual
$100 (Includes eText)
Enrollment
$75 (9 CEUs)

Prices subject to change without notice. Check pricing at owp.csus.edu

1 Introduction to Wastewater Collection
2 Wastewater Collection Systems: Purpose, Components, and Design
3 Safe Procedures
4 Inspecting and Testing Collection Systems
5 Pipeline Cleaning and Maintenance Methods
6 Underground Repair and Construction

Appendix A: Introduction to Basic Math for Operators
Answer Key, Glossary, Index

Instructor guides for wastewater series courses available for $35 to qualified instructors. Call for ordering information.

Operation and Maintenance of Wastewater Collection Systems
Vol 2, Eighth Edition

Volume 2 focuses on lift stations, maintenance, and system administration.

Manual
$100 (Includes eText)
Enrollment
$75 (6.4 CEUs)

Prices subject to change without notice. Check pricing at owp.csus.edu

1 Introduction to CMOM
2 Lift Stations
3 Equipment Maintenance
4 Rehabilitation
5 Management

Appendix A: Introduction to Basic Math for Operators
Answer Key, Glossary, Index

Instructor guides for wastewater series courses available for $35 to qualified instructors. Call for ordering information.

eLearning math course available!
See page 45
Collection Systems: Methods for Evaluating and Improving Performance

Third Edition

This course can assist collection system agencies in evaluating the effectiveness of their O&M program and identifying areas for improvement.

Manual
$80 (Includes eText)

Enrollment
$75 (3 CEUs)

This 6-topic DVD (30 minutes each) is designed for training potential, new, and experienced collection system operators working with both wastewater and combined collection systems. Each video demonstrates the equipment and procedures collection system crews use to safely and effectively operate and maintain their systems. Operators will learn how to properly identify, solve, and document solutions to existing and potential collection system problems.

DVD—$100
Enrollment—$75 (0.6 CEUs per course)

Video Topics

- Guardians of Health
- Importance of Operators, Inspection, and Testing
- TV Stars
- Closed-Circuit Television Inspection
- Pipe Detectives
- Pipeline Cleaning and Maintenance Methods
- Way Makers
- Pipeline Cleaning and Chemical Control
- Flow Movers
- Operation of Wastewater Lift Stations
- Motor Specialists
- Maintenance of Wastewater Lift Stations

Collection Systems Operation and Maintenance Training Videos

Collection Systems: Methods for Evaluating and Improving Performance

Instructor guides for wastewater series courses available for $35 to qualified instructors. Call for ordering information.

Prices subject to change without notice. Check pricing at owp.csus.edu

Manual
$80 (Includes eText)

Enrollment
$75 (3 CEUs)

DVD—$100
Enrollment—$75 (0.6 CEUs per course)
Small Wastewater System Operation and Maintenance
Vol 1, Second Edition

These courses focus on the practical, hands-on aspects of safely operating and maintaining small community wastewater collection, treatment, and effluent discharge systems, as well as several types of package wastewater treatment processes.

Manual
$49

Enrollment
$75 (9 CEUs)

Prices subject to change without notice. Check pricing at owp.csus.edu

1 The Small Wastewater System Operator
2 Small Collection, Treatment, and Discharge Systems
3 Safety
4 Septic Tanks and Pumping Systems
5 Wastewater Treatment and Effluent Discharge Methods
6 Collection Systems
7 Maintenance and Troubleshooting
8 Setting Rates for Small Wastewater Utilities

Appendix: Comprehensive Review Questions, Arithmetic, Words, Index

Instructor guides for wastewater series courses available for $35 to qualified instructors. Call for ordering information.

Small Wastewater System Operation and Maintenance
Vol 2, Second Edition

Volume 2 is designed to train operators in the daily practices of safely operating and maintaining small wastewater treatment and disposal systems.

Manual
$49

Enrollment
$75 (9 CEUs)

Prices subject to change without notice. Check pricing at owp.csus.edu

9 Wastewater Stabilization Ponds
10 Activated Sludge
11 Rotating Biological Contactors
12 Disinfection and Chlorination
13 Alternative Wastewater Treatment, Discharge, and Reuse Methods
14 Laboratory Procedures
15 Management

Appendix: Comprehensive Review Questions, Arithmetic, Words, Index

Prices subject to change without notice. Check pricing at owp.csus.edu

Instructor guides for wastewater series courses available for $35 to qualified instructors. Call for ordering information.
Industrial Waste Treatment
Vol 1, Third Edition

These courses are designed to train industrial wastewater treatment operators in the safe and effective operation and maintenance of industrial waste treatment facilities, with chapters focusing on preliminary and primary treatment processes.

<table>
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Prices subject to change without notice. Check pricing at owp.csus.edu

1. The Industrial Plant Operator
2. Industrial Wastewaters
3. Regulatory Requirements
4. Preventing and Minimizing Wastes at the Source
5. Industrial Waste Monitoring
6. Flow Measurement
7. Preliminary Treatment (Equalization, Screening, and pH Adjustment)
8. Physical–Chemical Treatment Processes (Coagulation, Flocculation, and Sedimentation)
9. Filtration
10. Physical Treatment Processes (Air Stripping and Carbon Adsorption)
11. Treatment of Metal Wastestreams
12. Instrumentation
13. Safety
14. Maintenance

Appendix: Comprehensive Review Questions, Words, Index

Industrial Waste Treatment
Vol 2, Third Edition

A continuation of Volume 1, Volume 2 focuses on secondary treatment, tertiary treatment, and residual solids management.

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Prices subject to change without notice. Check pricing at owp.csus.edu

1. The Industrial Plant Operator
2. Fixed Growth Processes (Trickling Filters and RBCs)
3. Activated Sludge Process Control
4. Sequencing Batch Reactors
5. Enhanced Biological Control
6. Anaerobic Treatment
7. Residual Solids Management
8. Maintenance

Appendix: Comprehensive Review Questions, Words, Index

Instructor guides for wastewater series courses available for $35 to qualified instructors. Call for ordering information.
Pretreatment Facility Inspection
Fourth Edition

This course is designed to train inspectors to use safe and efficient procedures when inspecting industrial pretreatment facilities. Topics include regulations, levels of inspection, measurement methods, and source control. Information about how inspectors can encourage industry professionals to develop waste minimization programs is provided.

Pretreatment Facility Inspection Training Videos

The 5-topic DVD provides an introduction to the knowledge, skills, and abilities needed by pretreatment facility inspectors. The 30-minute videos include real-world experiences and feature inspectors of industrial pretreatment facilities performing their duties. Current inspectors may learn tips for improving job performance.

Meeting the Goal Together
Discussing the pretreatment facility, inspection program, inspector and administrator responsibilities, environmental protection, and importance of ethical performance

Taking a Closer Look
Scheduling and conducting inspections, entering an industry for an inspection, level of inspection, after the walk-through, and report writing

Starting at the Source
Inspecting a metal finishing industry, on-site industrial inspections, pollution prevention, and data management

Taking Up a Collection
Reasons and preparation for sampling, collecting, handling, and transporting samples, as well as chain of custody

Going with the Flow
Sampling and flow monitoring, instrumentation, and automatic samplers

Manual
$100 (Includes eText)

Enrollment
$75 (7.5 CEUs)

DVD
$100

Enrollment
$75 (0.6 CEUs per course)

Instructor guides for wastewater series courses available for $35 to qualified instructors. Call for ordering information.

Prices subject to change without notice. Check pricing at owp.csus.edu

Prices subject to change without notice. Check pricing at owp.csus.edu

1 Introduction to Pretreatment Facility Inspection
2 Safety
3 Wastewater Characterization and Flow Monitoring
4 Inspection and Sampling
5 Pretreatment Program Management

Answer Key, Glossary, Index

Prices subject to change without notice. Check pricing at owp.csus.edu

Check pricing at owp.csus.edu
Struvite Precipitation Potential Calculation Tool

The struvite tool calculates the struvite precipitation potential for a facility based on water quality parameters input by the user. Using data to determine a facility’s struvite precipitation potential is important because struvite scale forms in wastewater digestion and post-digestion processes—often fouling equipment and obstructing pipes. Some facilities expend significant maintenance resources to control struvite formation and remove struvite accumulation.

The struvite tool allows the user to vary input parameters to determine what-if scenarios when conditions are changed to control struvite precipitation. This must-have tool for struvite control planning runs in Microsoft Excel® and includes user instructions.

Manual
$110 (Includes eText)
Enrollment
$75 (2.6 CEUs)

Prices subject to change without notice. Check pricing at owp.csus.edu

1 Water Quality and Employee Safety
2 Methods of Treatment
3 Operation and Maintenance (O&M)

Answer Key, Glossary, Index

Instructor guides for wastewater series courses available for $35 to qualified instructors. Call for ordering information.
MANAGEMENT COURSES
Utility Management
Third Edition

This course is designed to train water or wastewater utility agency managers in the use of good management practices. It focuses on the primary responsibilities of a utility manager and provides practical guidelines for policies and procedures.

Manage for Success
Effective Utility Leadership Practices

This course is designed to help utilities provide training to management staff. Topics include problem identification and solutions, working together as a team, communication, and motivation.

1  Supervising
2  Communicating
3  Human Relations
4  Planning and Organizing
5  Training and Teaching Skills
6  Problem-Solving Skills
7  Decision Making
8  Technical Issues and Regulatory Compliance
9  Financial Management
10  Computers in Managing a Utility
11  Emergency Planning
12  Health and Safety Programs
13  Community Relations
14  Personal and Professional Skills
Appendix: Final Exam, Index

Manual
$80 (Includes eText)
Enrollment
$75 (1.6 CEUs)

Manual
$49
Enrollment
$75 (4.5 CEUs)

Prices subject to change without notice. Check pricing at owp.csus.edu

1 Introduction to Utility Management
2 Managing for the Future

Answer Key, Glossary, Index
Select each item to learn more.

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eLearning Math Applications for Operators

Get ready to promote to the next grade or simply improve your math abilities. Our online math courses give you the skills and CEUs you need!

Each course focuses on math concepts related to water treatment plant operation, water distribution system operation, collection systems operation, or wastewater treatment plant operation. Students can practice solving work-related math problems in both US customary and metric units.

Step-by-step instructions show operators how to use math to solve problems typically encountered on the job. Audio notes, figures, and tables are included to expand the learning experience. Each course also offers a review of basic math concepts and operations. The courses do not attempt to cover the topics of any state certification exam.

All course material is offered online, but we recommend purchasing the training manual associated with each course for additional material on situations where operators use math on the job.

To order any of our eLearning math courses, please visit our website at the link below or by scanning the code with your smartphone!

owp.csus.edu/courses/math-courses.php

Math Applications in Water Distribution Systems
Enrollment—$250 (1.9 CEUs)

Math Applications in Collection Systems
Enrollment—$250 (1.8 CEUs)

Math Applications in Wastewater Treatment
Enrollment—$250 (3.3 CEUs)

Math Applications in Water Treatment
Enrollment—$250 (2.1 CEUs)
The **Water Treatment Plant Operation Specialist Certificate Program** consists of three courses in the operation and maintenance of water treatment facilities:

- Water Treatment Plant Operation 1 (CE 28A) $912
- Water Treatment Plant Operation 2 (CE 28B) $912
- Small Water System Operation and Maintenance (CE 29) $912

**Water Treatment and Wastewater Treatment**

We offer two certificate programs for academic credit. Both the **Water Treatment Plant Operation Specialist Certificate Program** and the **Wastewater Treatment Plant Operation Specialist Certificate Program** are designed for students seeking academic credit that may be transferred to other colleges and universities.

Registration requires university enrollment in the Sacramento State College of Continuing Education. If you are not planning to transfer your academic units to a college degree program, our other course offerings may better meet your needs.

Students enrolled in a certificate program earn academic credit for each course completed. Upon completion of all three courses in one of the certificate programs, students earn either a Water Treatment Plant Operation Specialist Certificate or a Wastewater Treatment Plant Operation Specialist Certificate, awarded by California State University, Sacramento.

Each course costs $912 and includes university enrollment, exam materials, administration and grading of an online final exam, and academic credits. The related training manuals are sold separately.

Contact the Sacramento State College of Continuing Education to register at (916) 278-6984 or [www.cce.csus.edu](http://www.cce.csus.edu).

*The specialist certificate programs are not available in some states. Please visit the link below for the California State University, Sacramento Office of Academic Affairs web page to see if our program is available in your state.*

[www.csus.edu/academic-affairs/academic-excellence/state-authorization.html](http://www.csus.edu/academic-affairs/academic-excellence/state-authorization.html)
Industrial Waste Treatment
Vol 1, Fourth Edition

This material is designed to train industrial wastewater treatment facility operators in the safe and effective operation of treatment processes used to treat industrial wastes for discharge to municipal wastewater conveyance and treatment systems or to receiving waters. Multiple courses using select chapters from the training manual offer students more flexibility to choose their topics of study and meet CEU requirements.

Streamlined for faster learning

- Updated descriptions and graphical representations of preliminary and primary treatment processes commonly used to treat wastewater generated from industrial processes
- Revised and expanded math concepts and example problems used in operations and troubleshooting
- Information on achieving regulatory compliance provided throughout
- Free eText access for 6 months

Industrial Waste Treatment
Vol 2, Fourth Edition

This material builds on the information in Volume 1 to train industrial treatment facility operators in secondary treatment processes and solids handling, reuse, and disposal. This volume continues to emphasize practices and procedures for safe, effective operation and regulatory compliance. Multiple courses using select chapters from the training manual offer students more flexibility to choose their topics of study and meet CEU requirements.

Membrane Bioreactors
Second Edition

This completely revised training manual presents information on the safe and effective operation of membrane bioreactors (MBRs). Concepts and strategies for using membranes in wastewater treatment, including instrumentation and control, are covered.
### US Customary Units

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<td>Concentration</td>
<td>mass/volume</td>
<td>mg/L</td>
</tr>
<tr>
<td>Flow rate</td>
<td>volume/time</td>
<td>ft&lt;sup&gt;3&lt;/sup&gt;/s (cfs)</td>
</tr>
<tr>
<td>Pressure</td>
<td>weight/area</td>
<td>lb/in&lt;sup&gt;2&lt;/sup&gt; (psi)</td>
</tr>
<tr>
<td>Density</td>
<td>mass/volume</td>
<td>lb/ft&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

### Unit Abbreviations

- in = inch
- min = minute
- ft = foot
- h = hour
- yd = yard
- d = day
- mi = mile
- y = year
- ac = acre
- Mgal/d = MGD
- gal = gallon
- gal/min = gpm
- Mgal = million gallon
- psi = lb/in<sup>2</sup>
- lb = pound
- hp = horsepower
- mol = mole

### Conversion Factors

<table>
<thead>
<tr>
<th>Measure</th>
<th>Unit</th>
<th>Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>ft</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>yd</td>
<td>3 ft</td>
</tr>
<tr>
<td></td>
<td>mi</td>
<td>5280 ft</td>
</tr>
<tr>
<td>Area</td>
<td>ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>144 in&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>ac</td>
<td>43560 ft&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Volume</td>
<td>ft&lt;sup&gt;3&lt;/sup&gt;</td>
<td>1728 in&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>ft&lt;sup&gt;3&lt;/sup&gt;</td>
<td>7.48 gal</td>
</tr>
<tr>
<td>Mass</td>
<td>lb</td>
<td>16 oz</td>
</tr>
<tr>
<td>Time</td>
<td>min</td>
<td>60 s</td>
</tr>
<tr>
<td></td>
<td>h</td>
<td>60 min</td>
</tr>
<tr>
<td></td>
<td>d</td>
<td>24 h</td>
</tr>
<tr>
<td></td>
<td>y</td>
<td>365 d</td>
</tr>
</tbody>
</table>

### Equivalent Units

<table>
<thead>
<tr>
<th>1 in</th>
<th>2.54 cm</th>
<th>1 ft&lt;sup&gt;3&lt;/sup&gt;</th>
<th>28.3 L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ft</td>
<td>30.48 cm</td>
<td>1 gal</td>
<td>3.785 L</td>
</tr>
<tr>
<td>1 ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.0929 m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>1 lb</td>
<td>453.6 g</td>
</tr>
<tr>
<td>1 ac</td>
<td>0.405 ha</td>
<td>1 oz</td>
<td>28.35 g</td>
</tr>
<tr>
<td>1 ft&lt;sup&gt;3&lt;/sup&gt;</td>
<td>0.0283 m&lt;sup&gt;3&lt;/sup&gt;</td>
<td>1 mi</td>
<td>1.6 km</td>
</tr>
<tr>
<td>1 psi</td>
<td>6895.93 Pa</td>
<td>1 atm</td>
<td>14.7 psi</td>
</tr>
</tbody>
</table>
### Metric Units

<table>
<thead>
<tr>
<th>Measure</th>
<th>Name</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>meter</td>
<td>m</td>
</tr>
<tr>
<td>Area</td>
<td>meter square</td>
<td>m²</td>
</tr>
<tr>
<td>Volume</td>
<td>meter cube</td>
<td>m³</td>
</tr>
<tr>
<td>Mass</td>
<td>gram</td>
<td>g</td>
</tr>
<tr>
<td>Time</td>
<td>second</td>
<td>s</td>
</tr>
<tr>
<td>Velocity</td>
<td>distance/time</td>
<td>m/s</td>
</tr>
<tr>
<td>Concentration</td>
<td>mass/volume</td>
<td>mg/L</td>
</tr>
<tr>
<td>Flow rate</td>
<td>volume/time</td>
<td>m³/s</td>
</tr>
<tr>
<td>Pressure</td>
<td>weight/area</td>
<td>Pa (N/m²)</td>
</tr>
<tr>
<td>Density</td>
<td>mass/volume</td>
<td>kg/m³</td>
</tr>
</tbody>
</table>

### Conversion Factors

<table>
<thead>
<tr>
<th>Measure</th>
<th>Unit</th>
<th>Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>m</td>
<td>100 cm</td>
</tr>
<tr>
<td></td>
<td>cm</td>
<td>10 mm</td>
</tr>
<tr>
<td></td>
<td>km</td>
<td>1000 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10⁴ cm²</td>
</tr>
<tr>
<td>Area</td>
<td>m²</td>
<td>10⁶ cm²</td>
</tr>
<tr>
<td></td>
<td>ha</td>
<td>104 m²</td>
</tr>
<tr>
<td></td>
<td>m³</td>
<td>10⁶ cm³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,000 L</td>
</tr>
<tr>
<td>Mass</td>
<td>kg</td>
<td>1,000 g</td>
</tr>
<tr>
<td>Time</td>
<td>h</td>
<td>60 min</td>
</tr>
<tr>
<td></td>
<td>min</td>
<td>60 s</td>
</tr>
<tr>
<td></td>
<td>d</td>
<td>24 h</td>
</tr>
<tr>
<td></td>
<td>y</td>
<td>365 d</td>
</tr>
</tbody>
</table>

### Unit Abbreviations

<table>
<thead>
<tr>
<th>cm = centimeter</th>
<th>kg = kilogram</th>
</tr>
</thead>
<tbody>
<tr>
<td>m = meter</td>
<td>mol = mole</td>
</tr>
<tr>
<td>km = kilometer</td>
<td>s = second</td>
</tr>
<tr>
<td>ha = hectare</td>
<td>min = minute</td>
</tr>
<tr>
<td>L = liter</td>
<td>h = hour</td>
</tr>
<tr>
<td>mL = milliliter</td>
<td>d = day</td>
</tr>
<tr>
<td>mg = milligram</td>
<td>y = year</td>
</tr>
<tr>
<td>g = gram</td>
<td>Pa = Pascal (N/m²)</td>
</tr>
</tbody>
</table>

### Equivalent Units

<table>
<thead>
<tr>
<th>1 cm</th>
<th>0.3937 in</th>
<th>1 L</th>
<th>0.0353 ft³</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 m</td>
<td>3.281 ft</td>
<td>1 L</td>
<td>0.2642 gal</td>
</tr>
<tr>
<td>1 m²</td>
<td>10.764 ft²</td>
<td>1 kg</td>
<td>2.205 lb</td>
</tr>
<tr>
<td>1 ha</td>
<td>2.47 ac</td>
<td>1 g</td>
<td>0.0353 oz</td>
</tr>
<tr>
<td>1 m³</td>
<td>35.315 ft³</td>
<td>1 km</td>
<td>0.6214 mi</td>
</tr>
<tr>
<td>1 kPa</td>
<td>0.1450 psi</td>
<td>1 atm</td>
<td>101325 Pa</td>
</tr>
</tbody>
</table>
### Water Properties

<table>
<thead>
<tr>
<th>Density</th>
<th>62.4 lb/ft³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>8.34 lb/gal</td>
</tr>
<tr>
<td>Density</td>
<td>1 kg/L</td>
</tr>
<tr>
<td>Density</td>
<td>1 g/cm³</td>
</tr>
<tr>
<td>1 ft water</td>
<td>0.433 lb/in² (psi)</td>
</tr>
<tr>
<td>1 m of water</td>
<td>9.81 kPa (kN/m²)</td>
</tr>
</tbody>
</table>

### SI Prefixes

<table>
<thead>
<tr>
<th>Name</th>
<th>Prefix</th>
<th>Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>giga</td>
<td>G</td>
<td>10⁹ = 1,000,000,000</td>
</tr>
<tr>
<td>mega</td>
<td>M</td>
<td>10⁶ = 1,000,000</td>
</tr>
<tr>
<td>kilo</td>
<td>k</td>
<td>10³ = 1,000</td>
</tr>
<tr>
<td>hecto</td>
<td>h</td>
<td>10² = 100</td>
</tr>
<tr>
<td>deca</td>
<td>da</td>
<td>10¹ = 10</td>
</tr>
<tr>
<td>deci</td>
<td>d</td>
<td>10⁻¹ = 0.1</td>
</tr>
<tr>
<td>centi</td>
<td>c</td>
<td>10⁻² = 0.01</td>
</tr>
<tr>
<td>milli</td>
<td>m</td>
<td>10⁻³ = 0.001</td>
</tr>
<tr>
<td>micro</td>
<td>µ</td>
<td>10⁻⁶ = 0.000001</td>
</tr>
<tr>
<td>nano</td>
<td>n</td>
<td>10⁻⁹ = 0.000000001</td>
</tr>
</tbody>
</table>

### Select Greek Characters in Math

<table>
<thead>
<tr>
<th>Character</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>γ</td>
<td>Gamma</td>
<td>Weight density, ( \gamma = \rho \times g ) where ( g ) is gravitational acceleration</td>
</tr>
<tr>
<td>Δ</td>
<td>Delta</td>
<td>Change (usually accompanied by another variable)</td>
</tr>
<tr>
<td>μ</td>
<td>Mu</td>
<td>Micro</td>
</tr>
<tr>
<td>π</td>
<td>Pi</td>
<td>Ratio of the circumference of a circle to its diameter</td>
</tr>
<tr>
<td>ρ</td>
<td>Rho</td>
<td>Mass density (for water ( \rho = 1 ) g/cm³)</td>
</tr>
<tr>
<td>Σ</td>
<td>Uppercase sigma</td>
<td>Sum</td>
</tr>
<tr>
<td>σ</td>
<td>Lowercase sigma</td>
<td>Standard deviation (refer to math appendix for details)</td>
</tr>
</tbody>
</table>

### Variables [example units]

<table>
<thead>
<tr>
<th>( A )</th>
<th>area [ft²]</th>
</tr>
</thead>
<tbody>
<tr>
<td>( C )</td>
<td>concentration [mg/L]</td>
</tr>
<tr>
<td>( Q )</td>
<td>flow rate [Mgal/d or ML/d]</td>
</tr>
<tr>
<td>( V )</td>
<td>volume [gal, L]</td>
</tr>
<tr>
<td>( v )</td>
<td>velocity [ft/s, m/s]</td>
</tr>
<tr>
<td>( H )</td>
<td>pressure head [ft, m]</td>
</tr>
<tr>
<td>( m )</td>
<td>mass [lb, kg]</td>
</tr>
<tr>
<td>( p )</td>
<td>pressure [lb/in², Pa]</td>
</tr>
<tr>
<td>( \rho )</td>
<td>density [lb/ft³, g/cm³]</td>
</tr>
<tr>
<td>( E )</td>
<td>efficiency [%]</td>
</tr>
<tr>
<td>( N )</td>
<td>normality [eq/L]</td>
</tr>
<tr>
<td>( M )</td>
<td>molarity [mol/L]</td>
</tr>
<tr>
<td>( t )</td>
<td>time [s]</td>
</tr>
<tr>
<td>( T )</td>
<td>temperature [°F, °C]</td>
</tr>
<tr>
<td>( D )</td>
<td>diameter [ft, m]</td>
</tr>
<tr>
<td>( LR )</td>
<td>loading rate [gal/ft/d, L/m/d]</td>
</tr>
<tr>
<td>( HLR )</td>
<td>hydraulic loading rate [cm/d]</td>
</tr>
<tr>
<td>( OLR )</td>
<td>organic loading rate [kg/m²/d]</td>
</tr>
<tr>
<td>( \text{Cl}_{\text{dose}} )</td>
<td>chlorine dose [mg/L]</td>
</tr>
<tr>
<td>( \text{Cl}_{\text{demand}} )</td>
<td>chlorine demand [mg/L]</td>
</tr>
<tr>
<td>( \text{Cl}_{\text{residual}} )</td>
<td>chlorine residual [mg/L]</td>
</tr>
<tr>
<td>( \text{Cl}_{\text{feed}} )</td>
<td>chlorine feed rate [kg/d]</td>
</tr>
<tr>
<td>( \text{BOD} )</td>
<td>biochemical oxygen demand [mg/L]</td>
</tr>
<tr>
<td>( \text{COD} )</td>
<td>chemical oxygen demand [mg/L]</td>
</tr>
</tbody>
</table>
Water and wastewater sector professionals are always in demand!

- Build a stable, well-paying career
- Protect public health
- Maintain critical infrastructure
- Continue learning throughout your career
- Advance your skills and pay
- Mentor new operators as a senior operator
- Teach the public about the water sector

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