

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

Center for Water Studies 130 – Water Distribution Systems

3 hours lecture, 3 units

Catalog Description

Study of the operation and maintenance of a water supply and distribution system. Water sources, water quality, treatment methods, distribution operations, customer metering, pipeline installation and repair, valves and appurtenances, storage tanks, and maintenance topics will be discussed. Includes mathematical and hydraulic formulas and principles to determine volume, flow, pressure and hydrostatic force. Support the State Water Resources Control Board (SWRCB) Water Distribution Operator certification series. Prepares students for SWRCB Water Distribution Operator grade D1 and D2.

Prerequisite

None

Recommended Preparation

“C” grade or higher or “Pass” in CWS 102 or equivalent

Entrance Skills

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

- 1) Perform dimensional analysis and solve problems related to water distribution systems.
- 2) Interpret and utilize graphs, tables and formulas to solve problems commonly encountered in water distribution systems.
- 3) Basic level algebra sufficient to solve equations with one or two variables.

Course Content

- 1) Public Health
 - a. Introduction, scope and objectives of course
 - b. Public health aspects of water supply
 - c. Drinking water standards
 - d. Cross connection control and backflow prevention
- 2) Sources of Water and Characteristics
 - a. Surface water
 - b. Groundwater
 - c. Reclamation
 - d. Physical, chemical and biological characteristics of each type
- 3) Water Production, Storage and Distribution
 - a. Water treatment processes and plant operations
 - b. Storage reservoirs and tanks
 - c. Pumping operations
 - d. Types of distribution systems
- 4) Mathematics and Hydraulics
 - a. Calculations and conversions relating to volume, flow rates, flow velocity, pump horsepower, and chemical dosages
 - b. Hydrostatics Forces
 - c. Pressure pipe flow and headloss

- d. Pumping rates
- e. Pump head and efficiency
- 5) Disinfection
 - a. Chlorine, properties and use
 - b. Chlorine reactions with various compounds
 - c. Chlorine safety
 - d. Breakpoint chlorination
 - e. Disinfectants other than chlorine
- 6) Pipes
 - a. Construction
 - b. Materials
 - c. Installation
 - d. Protection
 - e. Maintenance
 - f. Uses
- 7) Pipeline Appurtenances
- 8) Meters and Services
- 9) Pumps
 - a. Pumping terminology
 - b. Pumping principles
 - c. Types of pumps
 - d. Interpreting pump curves
- 10) Electrical/Instrumentation
 - a. Terminology
 - b. Types of control systems
 - c. Sensing and sampling devices
 - d. Readout devices
 - e. Remote control systems
- 11) Safety
 - a. Shoring pipe construction
 - b. Working in confined spaces
 - c. Working around construction equipment
 - d. Working with, on, or over water
- 12) Maps, Drawings and Records
- 13) Public Relations
 - a. Water quality complaints
 - b. Dealing with the media
 - c. Water quality standards violations
 - d. Public notification
- 14) Water System Operation
 - a. Daily operating procedures
 - b. Monitoring process information
 - c. Regulation of flows
 - d. Chemical use and handling
 - e. Operating records and reports
 - f. Emergency conditions and procedures

Course Objectives

Students will be able to:

- 1) Compare and contrast the different types of water distribution systems currently used in the United States.
- 2) Identify drinking water public health hazards and water quality standards common to the industry.
- 3) Using calculations and conversions, determine water flow, pressure, volume, velocity, hydrostatic force, and chemical dosage as related to operation of water distribution systems.

- 4) Identify and compare methods used to handle, install and repair water distribution pipe systems.
- 5) Explain principles of pump operation for the types of pumps used in water distribution systems including common problems, necessary adjustments, and typical packing gland problems.
- 6) Explain the electrical principles involved in control circuits common to water distribution systems.
- 7) Explain the required safe handling and storage of chlorine used in water distribution systems.
- 8) Interpret water system maps and drawings to determine location, type and characteristics of water distribution systems.
- 9) Specify necessary procedures needed to safely complete field work in a water distribution system.
- 10) Compare and contrast factors considered in the selection of pipe material, valves, meters, and related appurtenances.
- 11) Demonstrate the ability to read meters and calculate the meter accuracy.

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 and exams that measure students' ability to:
 - a. Characterize water sources and distribution systems and the water quality of these systems in relation to health hazards.
 - b. Calculate hydraulic flow, pressure, volume, velocity and force, and chemical dosage used in water distribution systems.
 - c. Compare and contrast various pipe, pump, water meters and control circuits common to water distribution systems.
 - d. Describe the appropriate safety procedures for field work and for work with chlorine common to water distribution systems.
- 2) Exercises that demonstrate students' ability to:
 - a. Analyze maps common to water distribution systems and use the maps to determine component type and location.
 - b. Demonstrate water meter use and accuracy of calculations.
- 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) Field trips
- 4) Demonstrations utilizing the Field Operations Skills Yard

Out-of-Class Assignments

- 1) Reading assignments
- 2) Writing assignments

Texts and References

- 1) Required (representative example): CSUS Office of Water Programs. *Water Distribution System Operation & Maintenance*. 7th edition, 2018. ISBN 978-1-323-83891-4.
- 2) Supplemental:
 - a. Lauer, William ed. *Water Distribution Operator Training Handbook*. 4th edition. American Water Works Association, 2013.

- b. Mays, Larry. *Water Transmission and Distribution: Principles and Practices of Water Supply Operations*. 4th edition. American Water Works Association, 2010.

Exit Skills

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

- 1) Identify the various sources of water available for use in water distribution systems and the characteristics that determine suitability for use in a potable water supply system.
- 2) Perform calculations and solve problems commonly encountered in water distribution systems, such as volumes, flow rates, velocities, pressures, and chemical dosage.
- 3) Demonstrate knowledge of safety hazards and safety measures related to working in water distribution systems.
- 4) Identify and describe the use and selection of common water distribution system components including pumps, motors, tanks, pipe, laterals, meters, valves, and control systems.

Student Learning Outcomes

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

- 1) Identify the various sources of water available for use in water distribution systems and the characteristics that determine suitability for use in a potable water supply system.
- 2) Perform calculations and solve problems commonly encountered in water distribution systems, such as volumes, flow rates, velocities, pressures, and chemical dosage.
- 3) Identify and describe safety hazards and safety measures related to working in water distribution systems.
- 4) Identify and describe the use and selection of common water distribution system components including pumps, motors, tanks, pipe, laterals, meters, valves, and control systems.
- 5) Pass SWRCB certification exams for Distribution Operator D1 and D2.