

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

CENTER FOR WATER STUDIES 230 – ADVANCED WATER DISTRIBUTION SYSTEMS

3 hours lecture, 3 units

Catalog Description

The second of an integrated sequence of courses covering water distribution systems. Students will gain a more comprehensive understanding of the operation and maintenance of a water supply and distribution system including advanced calculations, management, safety, and emergency response issues. Contemporary issues facing the water and wastewater industry will be explored in depth. Expands on topics covered in the introductory course, WWTR 130. Part of a series required for eligibility to take the California Department of Public Health (CDPH) Water Distribution Operator certification examinations; prepares students to take and pass CDPH Water Distribution Operator certification examinations for grades D3, D4 and D5.

Prerequisite

“C” grade or higher or “Pass” in CWS 130 or equivalent

Entrance Skills

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

- 1) Identify the various sources of water available for use in water distribution systems and the characteristics that determine the waters’ 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.

Course Content

- 1) Public Health: In-depth exploration and applications of:
 - a. Public health aspects of water supply
 - b. Drinking water standards
 - c. Cross connection control and backflow prevention
- 2) Sources of Water and Characteristics: Knowledge and applications of:
 - a. Distinct sources of surface water, groundwater and reclamation product
 - b. Physical, chemical and biological characteristics of each type
- 3) Water Production, Storage and Distribution
 - a. Comprehensive water treatment processes and plant operations
 - b. Storage reservoirs and tanks
 - c. Distinct types of distribution systems
 - d. Testing, monitoring and maintaining water quality in distribution systems
- 4) Mathematics and Hydraulics: Advanced calculations and conversions relating to:
 - a. Chemical dosages; hydrostatics
 - b. Flow rates, volumes and measurements
 - c. Pump rates, head and efficiency
- 5) Disinfection: Advanced knowledge and applications of:
 - a. Chlorine properties and use

- b. Chlorine reactions with various compounds
- c. Chlorine safety
- d. Breakpoint chlorination
- e. Disinfectants other than chlorine
- 6) Pipelines: Pipeline concepts and principles:
 - a. Construction and materials
 - b. Installation, protection and maintenance
 - c. Applications and uses
- 7) Pipeline Appurtenances
 - a. Specific types of valves: blow-offs and air valves
 - b. Applications for installation and maintenance; purposes and functions
- 8) Meters and Services
 - a. Specific types of meters and materials
 - b. Methods and practices in installation, maintenance and uses
- 9) Pumps and Motors
 - a. Advanced pumping terminology, pumping principles, types and uses of pumps
 - b. Applied interpretation of pump curves, motors, voltage power and efficiency
 - c. Installation and maintenance
- 10) Electrical/Instrumentation
 - a. Advanced terminology, types of control systems, sensing and sampling devices
 - b. Specific types of electronic signals, readout devices and remote control systems
 - c. SCADA systems, signal transmission and calibration
 - d. Data transmission methods and systems
- 11) Safety
 - a. Applied principles of trenching and shoring, pipe construction, working in confined spaces and working around construction equipment
 - b. Familiarity with safety regulations: MSDS documentation, OSHA regulations
- 12) Maps, Drawings and Records
 - a. Synthesis, analysis and interpretation of commonly used symbols, conventions and terminology used with various types of maps and construction drawings
 - b. Recordkeeping of as-build drawings, map ties, water production and maintenance records
- 13) Water System Operations
 - a. Daily operating procedures, monitoring process information, regulation of flows
 - b. Chemical use and handling operating records and reports
 - c. Emergency conditions and procedures
- 14) Management and Leadership Skills
 - a. General principals of organization
 - b. Administration
 - c. Communication and leadership
- 15) Emergency Response Planning and Operations
 - a. General principals of hazard assessment and vulnerability analysis
 - b. Standardized Emergency Management System (SEMS)
- 16) Public Relations
 - a. Assessment and response to water quality complaints
 - b. Interpretation and evaluation of water quality standards violations
 - c. Communications and dealing with the media
 - d. Standards for public notification and dealing with the public

Course Objectives

Students will be able to:

- 1) Distinguish and evaluate sources and characteristics of available water and their uses and applications, and demonstrate ability to compare and contrast different types of water distribution systems.

- 2) Interpret and synthesize drinking water public health hazards, water quality standards, and describe in detail testing and monitoring standards, processes and procedures for maintaining water quality in distribution systems.
- 3) Assess factors considered in the selection of pipe including the ability to read meters, calculate the accuracy, and understand the different types of meters and their practical applications.
- 4) Describe pump functions and operations, identify and assess pump problems, adjust and repack packing glands, and perform routine maintenance of pumps and motor.
- 5) Demonstrate understanding of advanced electrical terms, evaluate control circuits, sensing equipment, and SCADA and data transmission systems.
- 6) Analyze and evaluate mechanics and operations of chlorine delivery systems and safely perform chlorine related procedures, test for chlorine residual, and properly collect water samples from water distribution systems.
- 7) Interpret and analyze complex water distribution system maps, drawings, records, and as-built drawings.
- 8) Develop, maintain and interpret accurate water production and maintenance records, and explain the reason for maintaining thorough records.
- 9) Conduct required work safely by adhering to safety regulations and safe work practices.
- 10) Demonstrate understanding of general principles of management, organization, and leadership techniques as they relate to the water/wastewater industry.
- 11) Demonstrate understanding of general principles of emergency response planning and operations and hazard and vulnerability assessment of water distributions systems and facilities.
- 12) Take and pass California State Certification exams for Water Distribution Operator Grade D3 through D-5.

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) Projects
- 2) Writing assignments
- 3) Quizzes and exams
- 4) 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) Audiovisual
- 3) Field trips
- 4) Demonstrations utilizing the Field Operations Skills Yard

Out-of-Class Assignments

- 1) Reading assignments
- 2) Writing assignments
- 3) Projects

Texts and References

- 1) Required (representative example): Lauer, William ed. *Water Distribution Operator Training Handbook*. 4th edition. American Water Works Association, 2013.

- 2) Supplemental: Pizzi, Nicholas. *Basic Science Concepts and Applications*. 4th edition. American Water Works Association, 2010.

Student Learning Outcomes

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

- 1) Interpret public health standards applicable to water supply including drinking water standards, cross connection control and back-flow prevention.
- 2) Perform complex mathematical calculations and conversions relating to volumes, flow rates, velocities, pressure, hydrostatic force, chlorine dosage and meter accuracy.
- 3) Identify the proper methods to select, handle, install, repair, maintain and disinfect pipe, understand the different types of meters and their applications, explain pumping operations and assess common pump problems, knowledge of control systems and SCADA systems, comprehension of chlorine delivery systems and safe handling of chlorine.
- 4) Demonstrate familiarity with safety hazards, safety regulations and safe work practices.
- 5) Demonstrate understanding of the principals of management, organization and leadership techniques, knowledge of the principals of emergency response planning and operations and hazard and vulnerability assessment of water distributions systems and facilities.