Mt. San Jacinto College
Integrated Course Outline of Record

Form B

Submitted by: Melita Caldwell-Betties **Date:** 10/08/2020

Department	Subject	Course Number	Title
Water Technology	Water Technology WATR	507	Water Distribution I & II (formerly WATR-107)

Units/Hours

Each lecture unit requires 1 hour per week of class time, and 2 hours per week of study outside of class.
Each laboratory unit requires 3 hours per week of class time.
Each activity unit requires 2 hours per week of class time and 1 hour per week of study outside of class.

Lecture Units	Total Units
3.00	3.00
Lecture Contact Hours	**Total Contact Hours**
48.00 - 54.00	48.00 - 54.00
Lecture Homework Hours	
96.00 - 108.00	

Stand Alone:

Program Applicable

AA/AS Degree General Ed Breadth Area(s):

-none-

General Education Justification:

Maximum Enrollment: 40

Maximum Enrollment Justification: Justification:

Grading Method: Letter Grade or P/NP

TOP code: 0958.00*

Can be Taken 1 **time(s) for credit** (max 4)

- [ ] - Visual or Performing Arts course that is required to meet major requirements for UC/CSU
- [ ] - Intercollegiate athletics course
- [ ] - Academic/vocational competition course

Catalog Description:

(Please do not refer to transferability or degree, certificate, or employment concentration applicability. Please only describe the course).
(**75 words** or less in gray box below).

The course covers the sources of water, principles of design, installation, operation and maintenance of pipes, pumps, valves, meters, and other related hydraulic units. Operation and maintenance safety considerations are emphasized. The course is designed to prepare the student to take the State of California Water Distribution Operator exam.

Schedule Description:

(Please do not refer to transferability or degree, certificate, or employment concentration applicability. Please only describe the course).
(**25 words** or less in gray box below).

This course teaches students the principles of operation and maintenance of a water distribution system. Prepares students for the Water Distribution Operator examination.

Need for the course:

This is a core course in the water industry and an important building block towards a degree in water technology. This course is an elective in the Water Technology degree/certificate as well as the Environmental Studies: Water and Soil Technologies/Environmental Engineering Emphasis degree.

Prerequisite(s):

Prerequisites go through a separate approval process. See Forms E1-E6 for details.
(For further clarification, contact the Prerequisite Subcommittee)

-none-

Corequisite(s):

Corequisites go through a separate approval process. See Forms E1-E6 for details.

-none-

Recommend Preparation:

Recommended Preparation goes through a separate approval process. See Forms E1-E6 for details.

- WATR 790

Other Enrollment Criteria:

-none-

Learning Objectives:

(please number each objective and express in behavioral terms)
Upon the completion of the course the student will be able to do the following:

1. Improve the understanding waterworks terminology.
2. Distinguish the primary function of a water distribution system operator.
3. Differentiate the sources of ground water, surface water and their uses.
4. Analyze the basic elements of a water distribution system, as well as operation, maintenance and hydraulic characteristics.

5. Solve basic mathematical calculations and conversions such as: area, volume, flow, pressure and chemical dosage.
6. Evaluate water quality issues and how they relate to the operation of a water distribution system.
7. Evaluate disinfection options and their benefits/drawbacks.
8. Assess the safety issues pertinent to the water industry.
9. Diagram a typical water distribution system.

Course Content:

(please number the outline of main topics and subtopics)

1. Water distribution system operator
    1. Typical work and duties
    2. Job opportunities and sources to locate openings
    3. SWRCB requirements for certification, application deadlines, and continuing education units
2. Hydrologic cycle
    1. Sources of supply and source water protection
    2. Groundwater and surface water
    3. Well location, construction, yield, and terminology
    4. Surface water, storm water runoff, and infiltration
    5. Water quality and its impact on human health
3. Chemical, physical, and bacteriological characteristics
    1. Significance of organic and inorganic matter in water
    2. Fluoride - prevention of carries and mottling in teeth
    3. Nitrates and nitrites - methemoglobenemia
    4. Lead and copper - mental development, kidney and liver damage
    5. Calcium and magnesium - hardness
    6. Iron and manganese - stains, iron bacteria
    7. Coliform group - occurrence, significance, potential waterborne diseases
    8. pH - scale, measurement, significance
4. Maintenance of water quality in a distribution system-flushing operation
    1. Backflow prevention and cross-connection control
    2. Sampling requirements and collection procedures
        1. Bacteriological samples
        2. Copper and lead samples
        3. Volatile Organic Compound(VOC) samples
    3. Chlorine demand; its significance and relation to dose
    4. Chlorine residual measurement and reagents used
5. Purpose, configuration, and operation of a distribution system
    1. Water storage facilities such as elevated, standpipe, hydropneumatic, surge, clearwell, underground
    2. Valve such as gate, butterfly, globe, check, ball, and plug
    3. Meters such as positive displacement, current, compound, venturi, proportional
    4. Hydrants such as wet barrel and dry barrel
    5. Pumps and electric motors
        1. Causes of water hammer and cavitation
        2. Routine maintenance such as packing, bearings, alignments, priming
6. Piping installation, operation capacities and pressure
    1. Effects of pipe size, type and "C" factor
    2. Significance of head loss
    3. Causes and effects of tuberculation
7. Disinfection
    1. Purpose
    2. Chlorine and chlorine compounds

1. Characteristics
2. Storage
3. Containers
4. Detection of leaks
5. Hazards and safety requirement
6. Effects of pH, turbidity and temperature on chlorinatio
7. Standard disinfection methods for new/repaired distribution mains
8. Disinfection by products (DBPs) and formation of Trihalomethanes (THMs)

8. Safety
    1. Tailgate meeting
    2. Basic first aid
    3. Confined space entry
    4. Traffic control
    5. Trenching and shoring
    6. Occupational Safety and Health Administration (OSHA) compliance
    7. Respiratory protection and chlorine leaks
    8. Safety Data Sheets (SDS)
    9. Lock-out/tag-out procedures
    10. Emergency Response
    11. Public Relations
    12. Security
9. Water distribution mathematics
    1. Units and conversion factors
        1. Cubic feet to gallons and cubic yards
        2. Pressure - head to pounds per square inch (psi) and psi to head
        3. Gallons per minute (gpm) to cubic feet per second (CFS)
    2. Volume of water in cylindrical, rectangular tank, pipes
    3. Water level, given the volume of water and diameter of tank
    4. Well drawdown given the static and dynamic level
    5. Relation between the flow, velocity, and area
    6. Relation between chlorine dosage, demand, and residual

Methods of Instruction:

Methods of instruction may include, but are not limited to the following:

- **Method:** Lecture presentation and discussion
  Integration: Lecture presentation and discussion with supporting visual materials (overhead slides or multimedia), introducing concepts and terminology relevant to drinking water principles will be utilized throughout the course (e.g.: sources of water and related water quality issues, types of disinfection and their appropriate applications, distribution system operation, regulatory impacts and safe operating procedures).
- **Method:** Field Trips
  Integration: A field trip may be conducted to tour a water distribution system or booster station to expose students to water supply and delivery operations.
- **Method:** Videos and/or slides
  Integration: Videos and/or slides will be used to provide a better understanding of drinking water processes. Videos will include operation and maintenance activities as well as safe methods and techniques used in water supply, delivery, and treatment operations.
- **Method:** Group Discussion
  Integration: Small group discussion allows for students to discuss in detail, review, and application of content. This allows the students to put into practice/use terminology, processes, and issues in the field of drinking water operations.
- **Method:** Homework

Integration: Homework or take-home word problem worksheets with sample problems dealing with dosage rate, area, volume, and pressure will be assigned. Student writing may occur through private journal entries. Homework will be graded and discussed in both the traditional and virtual class setting.

- **Method:** Guest Lecturers
  Integration: Guest lecturers will enhance student's comprehension of the subject matter by exposing students to additional course content important to the water technology discipline of and consistent with their individual learning needs.
- **Method:** Activity
  Integration: Activities such as group discussion of current news articles will be utilized regarding the water supply and delivery alternatives; e.g. desalinization, recycle water, ground water recharge and latest information in the field. Readings from current periodicals will also be examined on recent advances in water resource management and related topics pertinent to the course.

Methods of Evaluation:

A student's grade shall be determined by the instructor using multiple measures of performance related to the course objectives. Methods of evaluation may include but are not limited to the following:

- **Method:** Periodic short objective tests
  Integration: Periodic short objective tests of course-related concepts will be used to assess the students' comprehension and retention of subject matters in water distribution operations and maintenance, including safe procedures. The final written work product will be graded for accuracy, completeness, demonstrated mastery of the subject matter.
- **Method:** Midterm and Final examination
  Integration: Periodic testing at the midpoint and final week of the semester will be utilized to determine content understanding of terminology, knowledge of subject matter, and the ability to evaluate drinking water operations. The final written work product will be graded for accuracy, completeness, demonstrated mastery of the subject matter.
- **Method:** Homework
  Integration: Written out of the classroom assignments to determine understanding of content, terminology and knowledge as well as demonstrate proficiency in the subject matter. The final written work product will be graded for accuracy, completeness, demonstrated mastery of the subject matter.
- **Method:** Special Projects and Case Studies
  Integration: Group or individual research projects, and case studies, of concepts developed throughout the course. Topic areas would include variety of operation and maintenance variables, system optimization, and water quality monitoring requirements in drinking water operations. The final work product will be graded for completeness and demonstrated mastery of the subject matter.
- **Method:** Class Work
  Integration: Class work consist of written assignments evaluating the ability to analyze and define drinking water terminology, concepts, and a variety of operation and maintenance variables for water supply and delivery systems. The final written work product will be graded for accuracy, completeness, demonstrated mastery of the subject matter.
- **Method:** Other
  Integration: Graded Assignments Integration: Student's worksheets will be assessed on the understanding of concepts covered, such as water sources and storage, system components, disinfection and operator safety.

Examples of Assignments:

Students will be expected to understand and critique college level texts or the equivalent. Reading and writing, as well as out of class assignments are required. These assignments may include but are not limited to the following:

1. Read the chapter on maintenance of storage tanks and be prepared to discuss, in class, the importance of corrosion control.
2. Complete a one page report on the following:
    1. Describe the three common methods used to disinfect water mains.

2. Describe the ways in which groundwater may become contaminated or degraded.
3. Solve the following math problem: An eighty-foot diameter tank contains 500,000 gallons of water. Calculate the height of water in the tank.
4. During class, a classroom discussion will be held on the safe handling of chlorine in storage. For example, chlorine is 2.5 times heavier than air and is highly corrosive in the presence of moisture. List the criteria which governs the placement of an exhaust system in a chlorine storage room.

Textbooks:

- Office of Water Programs (2018). *Water Distribution System Operation and Maintenance, 7th Edition* California State University at Sacramento. ISBN: 978-1-323-83891-4
- Shammas, Nazih K., Wang, Lawrence K (2015). *Water Engineering: Hydraulics, Distribution and Treatment* Wiley, John & Son Inc.. ISBN: 978-0-470-39098-6
- Lane, A., Norton M., Ryan, S. (2017). *Water Resources: A New Water Architecture* Wiley-Blackwell, Inc.. ISBN: 978-1-118-79390-9

Other Resources:

Minimum Qualification

- Environmental Technologies