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	790	Basic Waterworks Mathematics (formerly WATR-090)

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
2.00	2.00
Lecture Contact Hours	**Total Contact Hours**
32.00 - 36.00	32.00 - 36.00
Lecture Homework Hours	
64.00 - 72.00	

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).

This course is an introduction to the mathematics used in water industry. Students will learn the basic formulas and functions needed to calculate area, volume, instantaneous flow, chemical dosage and other related problems.

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 is an introduction to the fundamental and applied mathematics typically used in the water industry.

Need for the course:

This course will provide students with mathematical skills necessary to complete and be successful in the Water Technology Program and in real world situations. The course meets the requirements to obtain a certificate in Water Technology.

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.

-none-

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. Practice conversion of one unit of measurement to another using dimensional analysis.
2. Assess and select rules for solving applied basic waterworks math equations.
3. Evaluate expressions using the order of mathematical operations.
4. Perform basic operations such as multiplication and combination of like terms to find unknown variables.
5. Distinguish water distribution/treatment design and operating parameters.
6. Identify the appropriate mathematical units based on the process schematic or description.
7. Demonstrate an ability to extract relevant data and solve word problems.
8. Identify and apply algebraic techniques to solve simple and multi-step word problems routinely encountered in drinking

water systems and technology.
9. Analyze mathematical calculations required to effectively operate, evaluate, and maintain drinking water systems.
10. Select and apply mathematical plans for appropriate process control of water treatment processes and distribution systems based on data evaluation and mathematical modeling.

Course Content:

(please number the outline of main topics and subtopics)

1. Basic math
    1. Calculator skills
    2. Decimals
    3. Powers
    4. Averages
    5. Decimals and Rounding
    6. Percentages
2. Linear, area, and volumetric measurements
    1. Basic algebraic formula manipulation
    2. Ratios and proportions
3. Process control and evaluation
    1. Ponds and reservoirs
    2. Clarifiers and sedimentation tanks
    3. Filtration devices
4. Pumps and pumping systems
    1. Pump capcity
    2. Head and head loss
    3. Horsepower
    4. Energy demand
5. Laboratory calculations
    1. Density and specfic gravity
    2. Percent Strength
    3. Solution concentration
    4. Dilution and blending
    5. Temperature
6. General design considerations
    1. Detention time
    2. Surface loading or hydraulic
    3. Weir overflow rate
    4. Process efficiency
7. Rate of flow problems (Q=AV formula)
    1. Flow in channel
    2. Flow in pipeline
    3. Time to fill or empty a reservoir
    4. Pumping rate to fill or empty a reservior
    5. Fill volume given fill rate
8. “Pounds Formula” applications
    1. Chemical dosage, demand and residual
    2. Chemical feeder rates
    3. Loading rates
9. Word problems
    1. Unit conversions
    2. Dimensional analysis

Methods of Instruction:

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

- **Method:** Lecture
  Integration: Lecture presentation and discussion with supporting visual materials (overhead slides or multimedia) introducing concepts and terminology relevant to water treatment and distribution systems (e.g. conversions, order of operations, solving for unknown values, word problems, and operational parameters such as solids loadings).
- **Method:** Film/video Viewing and Discussion
  Integration: Videos will illustrate various aspects of wastewater treatment and collection system operations including normal and abnormal operating conditions typically encountered in the workplace. Relevant data will be extracted from the visual data and algebraic techniques covered in the course will be employed to solve simple and multi-step problems.
- **Method:** Homework
  Integration: Take-home word problem worksheets with sample problems such as conversions, order of operations, solving for unknown values, word problems, and operational parameters such regulating velocities and process control. Student writing may occur through private journal entries. Homework will be graded and discussed in both the traditional and virtual class setting.
- **Method:** Directed Study
  Integration: Students will conduct research related to concepts and skills developed throughout the course. Students will analyze mathematical calculations (i.e., process design, schematics, and operational parameters) to determine the level of optimization required increase water system efficiency.
- **Method:** In-class Exercises
  Integration: Instructor-led or small group activities and discussion of applied math concepts or wastewater treatment/collection strategies will be based on data evaluation and modeling. These activities may be rewarded with points for participation, but not necessarily graded with variable points. Students will be assessed on their comprehension and knowledge of unit process and control calculations.

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:** Quizzes
  Integration: Periodic short objective tests will be used to assess the students' comprehension and retention of applied math concepts and terminology (i.e. conversions, order of operations, solving for unknown values, word problems, and operational parameters) relevant to water treatment and distribution systems. The final written work product will be graded for accuracy, completeness, and demonstrated mastery of the subject matter.
- **Method:** Exams/Tests
  Integration: A combination of objective questions of important concepts (previously quizzed or discussed in class) will be given to assess the students' knowledge and comprehension on applied math calculations in water treatment and the maintenance of water distribution systems (i.e., demonstrating the ability to extract relevant data and select rules for solving math equations). The final written work product will be graded for accuracy, completeness and demonstrated mastery of the subject matter.
- **Method:** Homework
  Integration: Take-home word problem worksheets with algebraic expressions accessing studentâ€™s understanding of the order of operations, solving multi-step or unknown values equations and word problems. The final written work product will be graded on accuracy, completeness, and demonstrated mastery of the subject matter.
- **Method:** Class Work
  Integration: Practice word problem worksheets dealing with mathematical modeling of equipment used in water storage, distribution, and transportation systems. Student writing may also occur through private journal entries. Classwork will be graded for accuracy, completeness, and demonstrated mastery of the subject matter.
- **Method:** Graded assignments/worksheets
  Integration: Student's worksheets will be assessed on the ability to extract relevant mathematical data as well as articulate process, operational, and design parameters. The final written work product will be graded for accuracy, completeness, and demonstrated mastery of the subject matter

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 Chapters One, Two, and Three in the text and be prepared to take an in-class quiz.
    1. Example: " There are two approaches to calculating chlorine doses in milligrams per liter. Each approach will yield the same results; but have a slightly different form".
    2. Chlorine, lbs = (Volume, M Gal)(Dose, mg/L)(8.34 lbs/gal), we can arrange the equation and solve for the dosed in milligrams per liter.
    3. Chlorine Dose, mg/L = Chlorine, lbs (Volume, M Gal)(8.34 lbs/gal)
    4. If the basic equation is expressed as a chemical feeder setting in pounds per day, then the flow would be in million gallons per day (MGD).
    5. Chlorine Dose, mg/L = Chlorine, lbs/day Water, Million lbs/day
2. Solve the problems on a take-home assignment covering disinfection and solve for chlorine dosage in mg/L. Additional instructions will be given to discuss the assigned problems in class the following week.
3. Answer selected math review questions on detention time, surface loading rates, and process efficiency on the assigned chapter pages.

Textbooks:

- Giorgi, J. (2009). *Math for Water Treatment Operators: Practice Problems to Prepare for Water Treatment Operator Certification Exams* American Water Works Association. ISBN: 978-1583214541
- Price, J. K. (1998). *Applied Math for Water Plant Operators - Workbook* Taylor and Francis Group. ISBN: 9780877628750
- Price, J. K. (1991). *Basic Math Concepts for Water and Wastewater Plant Operators* (1st or current/e). Taylor and Francis Group. ISBN: 9780877628088
- Spellman, F. R. (2014). *Mathematics Manual for Water and Wastewater Treatment Plant Operators,* 2nd. ed.. ISBN: 9781482224214
- Price, J. K. (1991). *Applied Math for Water Plant Operators* Taylor and Francis Group. ISBN: 9780877628743

Other Resources:

Minimum Qualification

- Environmental Technologies