Mt. San Jacinto College
Integrated Course Outline of Record

Form B

Submitted by: Melita Caldwell-Betties **Date:** 12/17/2020

Department	Subject	Course Number	Title
Water Technology	Water Technology WATR	525	Test Procedures for Water and Wastewater (formerly WATR-125)

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).

This course prepares students to analyze and interpret test data relating to water/wastewater treatment plants. Topics include: Basic chemistry and related mathematical analyses involved in the operation of water/wastewater treatment plants; tests necessary to maintain process control of wastewater treatment plants as well as monitoring of industrial wastes prior to disposal; and proper methods for collecting and handling samples.

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 prepares students to safely analyze and interpret test data relating to water and wastewater treatment plants.

Need for the course:

This course compliments other courses in the Water Technology Program. It enhances student understanding of the technical aspects of water and wastewater treatment and distribution in the areas of chemistry, biology and microbiology. This course is an elective in the Water 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 or
- WATR 503 or
- WATR 507 or
- WATR 520

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. Explain the basic concepts of the composition of matter in terms of atomic structure, ionic and covalent bonding,

solutions, emulsions, suspensions, and mixtures.
2. Identify chemically related hazards that are associated with water quality treatment technicians, work areas and tasks and explain why precautions are necessary regarding asphyxiating, toxic and flammable and/or explosive materials.
3. Evaluate chemical reactions and end products that occur in water/wastewater treatment disinfection, ion exchange, bio-oxidation, anaerobic digestion, coagulation, volatile acid and alkalinity analyses, and corrosion.
4. Compare and contrast the fundamentals involved in gravimetric and titrametric analyses of constituents of water, wastewater or sludge.
5. Assess process control variables for such treatment processes as dissolved air floatation, chlorine disinfection, dechlorination, nitrification and denitrification, coagulation for sedimentation and sand filtration, supervisory control systems, and other processes common to water and wastewater utilities.
6. Evaluate chemical reactions and end products that occur in water/wastewater treatment disinfection, ion exchange, bio-oxidation, anaerobic digestion, coagulation, volatile acid and alkalinity analyses.
7. Distinguish the fundamentals involved in gravimetric and titrametric analyses of constituents of water, wastewater, and sludges.
8. Calculate results for analyses of samples for dissolved oxygen, biochemical oxygen demand, all solids determinations, alkalinity, volatile acids and chlorine residual.
9. Formulate monitoring laboratory test plans for various water and wastewater trouble shooting scenarios.

Course Content:

(please number the outline of main topics and subtopics)

1. Chemistry application in water treatment
2. Branches of chemistry
3. Physical and chemical propertieas
4. Conservation of matter and energy
5. Atomic structure
    1. Protons, neutrons and electrons
    2. Isotopes, periodic table
    3. Atomic numbers and weights
6. Chemical bonds
7. Gas laws and diffusion
8. Organic compounds
    1. Carbon bonds
    2. Hydrocarbons
    3. Organic radicals or groups
    4. Alcohols
    5. Organic acids
    6. Carbohydrates
9. Colloids: kinds and significance
10. Hardness and water softening
11. Laboratory safety procedures
12. Laboratory equipment
13. Laboratory instrumentation and automation
14. Mathematics of analysis
15. Recordkeeping
16. Sampling techniques
    1. Water sample collection
    2. Preservation
    3. Storage
    4. Transportion
17. Quality Assurance/Quality Control Program
18. Fundamentals of laboratory procedures
    1. Gravimetric
    2. Calorimetric

3. Volumetric
19. Controlled reactions and oxidation-reduction reactions
20. Concentration, equivalent weight & normality
21. Reaction equilibrium
22. Physical analysis of water/wastewater analysis and interpretation of results
    1. Temperature
    2. Turbidity
    3. Solids
    4. Color
    5. Threshold Odor Number
    6. Hardness
    7. Iron
    8. Manganese
23. Chemical analysis of water/wastewater analysis and interpretation of results
    1. Alkalinity
    2. Ph
    3. Titrations
    4. Dissolved Oxygen
    5. Oxygen Demand
    6. Conductivity
    7. Chlorine chemistry
        1. Chlorine properties
        2. Chlorine reactions in water
        3. Hypochlorites
        4. Chloramines
        5. Organochloramines
        6. Free versus combined chlorine
        7. Chlorine analyses
    8. Nitrogen
        1. Nitrogen cycle in nature
        2. Significance of nitrogen in water
        3. Nitrogen analyses
    9. Phosphorus removal and alkalinity
    10. Volatile acids/alkalinity
    11. Jar tests
        1. Coagulants
        2. Coagulant aids
24. Bacterialogical examination of water and wastewater samples and interpretion of results
    1. Microscopic staining
    2. Total coliform
    3. Fecal coliform
    4. Heterotrophic plate count/pour plate method
25. Laboratory safety
    1. Personal protective equipment
    2. Chemcial handling
    3. Bacterial analyses

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/wastewater laboratory principles throughout the course (e.g., sampling and laboratory safety, quality assurance/quality control, weights, volumes and concentrations).

- **Method:** Guest Lecturers
  Integration: Guest lecturers will enhance students comprehension by exposing students to people performing water quality analysis and sampling.
- **Method:** Supplemental material
  Integration: Supplemental material will include reviews of current news articles concerning water or wastewater issues such as new technology, advances in process control, sludge disposal, and industrial waste, and safety.
- **Method:** Audiovisual
  Integration: Videos and/or slides will be used to provide a better understanding of water or wastewater processes or activities. Videos will include on site processes such as safety issues, current issues in water supply, delivery and treatment systems.
- **Method:** Lab Activities
  Integration: The wet lab activities will evaluate chemical reactions and end products that occur in water/wastewater treatment disinfection, ion exchange, bio-oxidation, anaerobic digestion, coagulation, volatile acid, alkalinity analyses and corrosion.
- **Method:** Discussion
  Integration: Small group discussion allows for students to discuss in detail, review, and application of content. This allows for students to put into practice/use terminology, processes, and issues in the field of water and wastewater treatment operations

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:** Special projects and case studies
  Integration: Special projects and case studies will be utilized to compare and contrast a variety of wastewater topics that may include the fundamentals involved in gravimetric and titrametric analyses of constituents of water, wastewater, and sludges. The final work product will be graded for demonstrated mastery of the subject matter.
- **Method:** Class Work
  Integration: Students will be evaluated on a variety of in class assignments demonstrating an understanding of and ability to analyze and define water and wastewater analysis, terminology, concepts, and a variety of process control variables for certain treatment processes. The final written work product will be graded for accuracy, completeness, demonstrated mastery of the subject matter.
- **Method:** Quizzes
  Integration: Periodic short objective tests of course-related concepts such as how water or wastewater treatment systems rely on laboratory data to operate; safety in the laboratory; and, identifying process control variables for treatment processes such as dissolved air floatation, chlorine disinfection and nitrification. The final written work product will be graded for accuracy, completeness, demonstrated mastery of the subject matter.
- **Method:** Home Work
  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:** 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 and knowledge of subject matter. The final written work product will be graded for accuracy, completeness, 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 the section on laboratory safety. Be prepared to discuss, in class, the procedures and precautions which must be followed while handling chemicals commonly used in the analysis of water.
2. Dissolved oxygen (DO) is not considered a contaminant, though it plays an important role in water. Write a one page report on the role of DO on taste and palatability of drinking water and its corrosivity. Also, describe how DO plays an important role in management of reservoirs.
3. A wastewater plant is discharging a partially nitrified effluent. How might this impact the Biological Oxygen Demand (BOD) test on the effluent?

Textbooks:

- Water Environment Federation (2012). *Basic Laboratory Procedure for the Operator-analyst* WEF. ISBN: 9781575040127
- Eaton, A.D., Rice, E.W., Baird, R.B. editors (2017). *Standard Methods for the Examination of Water and Wastewater* American Public Health Association, American Water Works Association, Water Environment Federation. ISBN: 9780875532875
- Benjamin, Mark M (2015). *Water Chemistry* Waveland Press, Inc. . ISBN: 978-1-4786-2308-X
- Keen, P. L., Fugere, R. (2017). *Antimicrobial Resistance in Wastewater Treatment Processes* Wiley-Blackwell. ISBN: 978-1-119-19243-5

Other Resources:

Minimum Qualification

- Environmental Technologies