

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

CENTER FOR WATER STUDIES 112 – WATER TREATMENT PLANT OPERATIONS

3 hours lecture, 3 units

Catalog Description

Study of the sources of water and the public health aspects of water supply; chemical, physical and bacteriological standards of water quality; types of water treatment plants; and water treatment procedures, operation, maintenance, storage and distribution.

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 calculations necessary to solve problems related to water and wastewater treatment, delivery and collection.
- 2) Interpret and utilize graphs, tables and formulas in the calculation of various loading and pumping rate equations, chemical dose equations, and dilution factors used in the water and wastewater industry.

Course Content

- 1) Introduction
 - a. Scope and objectives of course
 - b. Public health aspects of water supply
 - c. Water pollutants
 - d. Sources of pollution
 - e. Protection
 - f. Removal of polluting substances
- 2) Chemical standards of water quality
 - a. Types of standards
 - b. Sample collection
 - c. EPA standards
 - d. State of California standards
 - e. Report of results
- 3) Bacteriological standards of water quality
 - a. EPA standards
 - b. State of California standards
 - c. Responsibility for conditions in water supply system
 - d. Sample collection
 - e. Bacteriological examination
 - f. Report of results

- 4) Chemistry
 - a. Review of chemistry symbols
 - b. Natural waters as mineral solutions
 - c. Predominant ions in natural waters
 - d. Character of water affected by ions present
 - e. Acids, bases and salts
 - f. Hydrogen ion
 - g. Formulas of water treatment chemicals
- 5) Biology - organisms of interest in water treatment
 - a. Bacteria and viruses
 - b. Cryptosporidium and Giardia
 - c. Geosmin and MIB
 - d. Plankton, higher aquatic plants
- 6) Applied mathematics
 - a. Units
 - b. Conversion factors
- 7) Chemical and physical pretreatment
 - a. Objectives
 - b. Aeration
 - c. Solids removal
 - d. Coagulation and flocculation
 - e. Sedimentation
 - f. Chemical feeding devices
- 8) Filtration
 - a. Methods and controls of filter operation
 - b. Types of filters
 - c. Filter controls
 - d. Operation and maintenance
 - e. Records
- 9) Tastes and odors
 - a. Causes and control
 - b. Removal of tastes and odors
 - c. Color: types, causes and control, methods of color removal
 - d. Laboratory monitoring
- 10) Scaling and corrosion
 - a. Objectionable features
 - b. Basic features
 - c. Control of scaling and corrosion
- 11) Desalination
 - a. Introduction to desalination and desalting methods
 - b. Water supply and needs in California
- 12) Laboratory
 - a. Lab equipment
 - b. Records keeping
 - c. Safety
 - d. Sampling
 - e. Testing

Course Objectives

Students will be able to:

- 1) Describe the chemical standards of water quality.
- 2) Discuss the bacteriological standards of water quality.
- 3) Demonstrate understanding of the biological organisms of interest in water treatment.
- 4) Perform mathematical calculations necessary in the treatment of potable water.

- 5) Discuss the need for chemical and physical pretreatment of water prior to treatment.
- 6) Describe the types, methods and controls of filter operations.
- 7) Discuss the types, causes, and control of tastes and odors.
- 8) Describe the methods used to control scaling and corrosion.
- 9) Comprehend the techniques used to desalinate ocean or brackish water.
- 10) Demonstrate knowledge of the uses of laboratory equipment, sampling techniques, and laboratory safety.

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. Identify water sources, describe appropriate treatment, and prepare plans to utilize water and wastewater treatment methods common to the industry.
 - b. Analyze problems common to water distribution and treatment and suggest plans for utilizing materials, methods and procedures common to the industry to address problems.
 - c. Determine water quality in relation to microbiological and chemical components.
 - d. Calculate water flow, pressure, velocity, chemical dosage in relation to water treatment systems.
 - e. Establish a plan for appropriate safety procedures necessary for a water treatment or distribution system.
- 2) Exercises that demonstrate students' ability to:
 - a. Calculate water flow, pressure, velocity, and chemical dosage in relation to water treatment systems.
 - b. Establish a plan for appropriate safety procedures necessary for a water treatment or distribution system.
- 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 examples):
 - a. California Department of Health Services, U.S. Environmental Protection Agency, Sanitary Engineering Branch, and Office of Drinking Water. *Water Treatment Plant Operation: A Field Study Training Program, Volume I*. 5th edition. CSU Sacramento Foundation, 2005.
 - b. Kerri, Kenneth. *Water Treatment Plant Operation, Volume I*. 7th edition. CSU Sacramento Foundation, 2017.

- c. Pizzi, Nicholas and William Lauer. *Water Treatment Operator Training Handbook*. 3rd edition. American Water Works Association, 2013. ISBN: 9781583218617

2) Supplemental: None

Exit Skills

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

- 1) Describe various methods and techniques used in water treatment including use of chlorine, fluoridation and desalination.
- 2) Describe safety procedures necessary for operating water treatment facilities.
- 3) Describe basic water quality parameters and demonstrate the tests for monitoring water quality.
- 4) Perform calculations for chemical dosages, detention time, volume, flow, filter loading, sedimentation, hydraulics and organic loading.
- 5) Describe the sources of water and characteristics of water from different sources.

Student Learning Outcomes

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

- 1) Identify in detail characteristics and sources of ground water and surface water supplies including the chemical, physical and bacterial characteristics, and explain the effects on quality of geological formations, stratifications, and watershed management.
- 2) Demonstrate knowledge of the five main processes found in conventional treatment plants.
- 3) Demonstrate understanding of drinking water quality standards and public health issues.
- 4) Explain the use of chlorine, the characteristics of and methods for storing, feeding and measuring chlorine, the effects of moisture, pH and temperature on feed rate, as well as the health and safety effects, procedures and personal protective requirements when using chlorine.
- 5) Determine the methods used for coagulation, flocculation and sedimentation including common chemicals used, feed systems, effects of time temperature, turbidity and pH, and the measurement of turbidity and color.
- 6) Demonstrate through testing basic knowledge of the regulations for monitoring water quality and performing water treatment.
- 7) Perform basic mathematical calculations and conversions relating to water flow, pressure, volume, velocity, chemical dosage, and CT (Concentration x Time) compliance.