

**CUYAMACA COLLEGE**  
COURSE OUTLINE OF RECORD

**CENTER FOR WATER STUDIES 212 – ADVANCED WATER TREATMENT PLANT OPERATIONS**

3 hours lecture, 3 units

**Catalog Description**

The study of water quality control and treatment. Aspects of public health as it relates to the water supply will be highlighted. Sources of contamination and methods of control will be emphasized as well as maintenance of water treatment facilities, safety, cost, and environmental factors.

**Prerequisite**

“C” grade or higher or “Pass” in CWS 112 or equivalent

**Entrance Skills**

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

- 1) Describe various methods and techniques used in water treatment including use of chlorine and other chemicals.
- 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 commonly used in a treatment plant, including 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.

**Course Content**

- 1) Introduction
  - a. Scope and objectives of course
  - b. Sources of water and their characteristics: meteoric water, surface water, ground water, other sources
  - c. Water cycle and balance
- 2) Public health aspects of water supply
  - a. The problem
  - b. Fundamental concepts of common water-borne diseases
  - c. Sources of pollution
  - d. Examples of sanitary defects
  - e. Water purification
- 3) Chemical standards of water quality
  - a. Types of standards
  - b. Simple collection
  - c. EPA and California standards of water quality
  - d. Goals and professional water quality standards
  - e. Alternative processes
- 4) Bacteriological standards of water quality
  - a. EPA and California standards of water quality
  - b. Responsibility for conditions in water supply system
  - c. Sample collection
  - d. Bacteriological examination
  - e. Necessary action in event of excessive coliform levels
  - f. Reports

- 5) Chemistry and water treatment
  - a. pH, hardness, and alkalinity
  - b. Acids and bases
  - c. Titration end points
  - d. Chemical reactions in water treatment
- 6) Biology
  - a. Characteristics
  - b. Organisms of interest in water treatment and operations: bacteria, viruses, plankton, higher aquatic plants, other aquatic organisms
- 7) Applied mathematics
  - a. Conversion factors
  - b. Hydraulic computations
  - c. Volume and flow rate computations
  - d. Dilution and blending computations
  - e. Weir overflow, surface overflow, filter loading, and backwash computations
- 8) Filtration methods and control
  - a. Purpose of filtration
  - b. Types of filters
  - c. Mechanism of filtration
  - d. Filter controls
- 9) Filter operation and maintenance
  - a. Requirements for effective filtration
  - b. Filtration rates
  - c. Filter backwash
  - d. Filter problems
  - e. Reconditioning filters
  - f. Filter control instruments
  - g. Records
- 10) Advanced disinfection
  - a. Properties and use of chlorine
  - b. Chlorine reactions with various compounds
  - c. Safety
  - d. Chlorination equipment
  - e. Ozone generation and usage
  - f. Chlorine dioxide
- 11) Fluoridation methods and control
  - a. Physiological effects of fluorides
  - b. Sources of fluorides in water
  - c. Fluoride compounds
  - d. Fluoride feeding equipment
  - e. Control methods
  - f. Safety
- 12) Applied hydraulics review
  - a. Pumps and motors
  - b. Operation and maintenance
  - c. Treatment plant electrical system review
  - d. Power
  - e. Control equipment
  - f. Equipment grounding
  - g. Treatment plant records and logs

### **Course Objectives**

Students will be able to:

- 1) Describe the sources of water and their characteristics

- 2) Discuss the public health aspects of water supply
- 3) Understand the chemical standards of water quality
- 4) Describe the bacteriological standards of water quality
- 5) Discuss the various processes utilized in water treatment operations
- 6) Discuss the biological organisms of interest in water treatment operations
- 7) Apply mathematical formulas and calculations in solving common water treatment problems
- 8) Understand filtration methods, control, operation, and maintenance
- 9) Discuss advanced disinfection techniques commonly used in water treatment plant operations
- 10) Describe fluoridation methods and control techniques

### **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
- 4) Exams (objective, essay)
- 5) 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) Projects
- 5) 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 examples):
  - a. Kawamura, Susumu. *Integrated Design and Operation of Water Treatment Facilities*. 2nd edition. Wiley, 2000.
  - b. Kerri, Kenneth. *Water Treatment Plant Operation, Volume 2*. 6th edition. CSU Sacramento Foundation, 2015.
- 2) Supplemental: None

### **Student Learning Outcomes**

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

- 1) Explain in detail how water is treated for iron and manganese, excessive hardness, and fluoride compliance.
- 2) Describe the operation of the four types of membranes and how membrane processes are used in water treatment systems.
- 3) Describe optimization techniques and best available technologies for water treatment systems.

- 4) Describe the chemical and bacteriological standards of water quality, calculate quantities of specific constituents in water and discuss how variations in these constituents affect treatment processes and water quality.
- 5) Interpret federal and state laws and regulations and explain how they relate to water treatment processes.
- 6) Perform mathematical calculations and conversions relating to volume, flow, hydraulic computations, water softening, hardness, and chemical precipitation.