

**CUYAMACA COLLEGE**  
COURSE OUTLINE OF RECORD

**CENTER FOR WATER STUDIES 214 – ADVANCED WASTEWATER TREATMENT PLANT OPERATIONS**

3 hours lecture, 3 units

**Catalog Description**

This course examines how modern wastewater treatment plants are operated to maximize efficiency and reliability in processing municipal wastewater. Emphasis on wastewater treatment plant facilities, equipment, preventative maintenance procedures, plant process monitoring & control, and safety & regulatory compliance.

**Prerequisite**

“C” grade or higher or “Pass” in CWS 114 or equivalent

**Entrance Skills**

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

- 1) Describe wastewater sources and compare treatment processes and requirements.
- 2) Describe preliminary, primary, secondary and tertiary wastewater treatment.
- 3) Perform mathematical calculations related to system volume, flow, hydraulics, chemical dosages and organic loading.
- 4) Describe safety regulations and procedures for wastewater treatment.
- 5) Describe wastewater system components.

**Course Content**

- 1) Introduction
  - a. Scope and objectives of course
  - b. Overview of levels of wastewater treatment
  - c. Federal and state regulations
  - d. Effluent disposal
- 2) Regulatory Compliance
  - a. Identifying various types of waste discharges
  - b. Recognizing the effects of waste discharges on receiving waters
  - c. Understanding the reasons for preventing pollution
  - d. Describe the role of the Environmental Protection Agency (EPA) in pollution control efforts
  - e. Defining the categories or types of industrial discharges regulated under the Clean Water Act
  - f. Explaining which types of industrial discharges are regulated by the National Pollutant Discharge Elimination System (NPDES) permit program
  - g. Obtaining information on how to safely store and handle chemicals from a Material Safety Data Sheet (MSDS)
  - h. Determining the information employers must provide to operators regarding and handling of and exposure to hazardous materials in the workplace (employee Right-To-Know legislation)
- 3) Flow diagrams of typical treatment processes
  - a. Pre-treatment and primary treatment
  - b. Secondary treatment
  - c. Component processes
  - d. Interaction of component processes
  - e. Brief summary of how components function
- 4) Sampling and Testing

- a. Collecting representative samples of influents to and effluents from a treatment process as well as sample the process
  - b. Preparing samples for analysis
  - c. Performing plant control tests, such as BOD<sub>5</sub>, Coliform Bacteria, DO, etc.
  - d. Analyzing plant effluent in accordance with NPDES permit requirements
  - e. Recognizing shortcomings or precautions for the plant control and NPDES permit requirements
  - f. Working safely in a laboratory and properly recording laboratory tests results
- 5) Odor Control
- a. Determining the source and cause of odors
  - b. Responding to odor complaints
  - c. Solving odor problems
- 6) Nitrogen and Phosphorus Removal
- a. Explaining the need for Nitrogen and Phosphorus removal
  - b. Describing some of the systems used to remove Nitrogen and Phosphorus at various treatment plants
  - c. Sample influent and effluent, interpret laboratory results, and make appropriate adjustments in the treatment process
  - d. Recognizing abnormal operating conditions and taking corrective action to ensure proper Nitrogen and Phosphorus removal.
- 7) Solids Thickening and Stabilization
- a. Discussing the various methods of solid handling and knowing how to operate and maintain these processes
  - b. Determining loadings on solids handling facilities and sludge digesters
  - c. Explaining how a sludge digester work and the factors that influence and control the digester process
  - d. Collecting samples, interpret laboratory results, and make appropriate adjustments in the solids handling processes and sludge digesters
  - e. Recognizing factors that indicate that solids handling processes and sludge digesters are not performing properly, identify the source of the problem, and take corrective actions
- 8) Industrial Waste Treatment
- a. Explaining the type of work done by an industrial wastewater treatment plant operator
  - b. Describing the general types of contaminants found in the wastewater from various industries
  - c. Explaining the differences between industrial waste treatment and pollution prevention
  - d. Identify general types of pollution prevention opportunities in the areas of good operating practices, material substitution, and process modification
  - e. Explaining the difference between concentration and mass of pollutants
  - f. Describing the effects of industrial wastewaters on wastewater collection, treatment, and disposal systems
  - g. Identifying industrial pollution sources and recommend techniques to minimize pollutants at the source
- 9) Wastewater Reclamation and Reuse
- a. Describing the various methods of wastewater reclamation and reuse
  - b. Developing operational strategies for wastewater reclamation and reuse
  - c. Monitor wastewater reclamation and reuse programs and make appropriate adjustments in treatment processes.

### **Course Objectives**

Students will be able to:

- 1) Assess and evaluate the performance and operation of various wastewater unit processes.
- 2) Calculate quantities of specific constituents in wastewater and describe their sources.
- 3) Interpret federal and state laws and regulations as they relate to wastewater treatment processes including NPDES permit requirements.
- 4) Discuss the options for water recycling and future industry trends.

- 5) Identify, evaluate and suggest potential solutions for safety hazards applicable to wastewater treatment operations.
- 6) Demonstrate knowledge and usage of proper wastewater plant terminology.
- 7) Comprehend the principles of operating an advanced wastewater treatment plant.
- 8) Use mathematical computations to assess and evaluate performance and operation of various advanced wastewater treatment unit processes.
- 9) Describe important technical concepts associated with advanced wastewater treatment both orally and in writing.
- 10) Demonstrate workplace-related safety skills and positive workplace attitudes required of a knowledgeable wastewater professional.
- 11) Demonstrate comprehension of advanced computer operations and skills related to wastewater treatment process control by wastewater treatment simulation software.

### **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) Homework assignments
- 3) Quizzes
- 4) Exams
- 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) 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. *Operation of Wastewater Treatment Plants, Volume 2*. 7th edition. CSU Foundation, 2007.
- 2) Supplemental: None

### **Student Learning Outcomes**

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

- 1) Explain in detail, the purpose of each advanced wastewater treatment plant process.
- 2) Compare normal and abnormal operational procedures including the application of laboratory results to process control and equipment and facilities maintenance.

- 3) Describe federal and state laws and regulations as they apply to wastewater treatment processes.
- 4) Describe how SCADA systems are used to monitor and control wastewater treatment plant processes and performance.
- 5) Explain how wastewater treatment plant operations are achieving improved sustainability through water reclamation, bio-gas and bio-solids harvesting, and power co-generation.