

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

CENTER FOR WATER STUDIES 114 – WASTEWATER TREATMENT PLANT OPERATIONS

3 hours lecture, 3 units

Catalog Description

An introduction to the basic principles involved in the operation of conventional public wastewater treatment plants. Provides information on plant hydraulics, preliminary, primary and secondary treatment processes, disinfection, as well as environmental and safety regulation compliance.

Prerequisite

None

Course Content

- 1) Introduction
 - a. Scope and objectives of course
 - b. Units of measurement (metric and English)
 - c. Relationship of sewage to public health
 - d. Reasons for treating sewage
- 2) Sources and quantities of water and sewage
 - a. Characteristics of sewage
 - b. Estimating quantities of sewage
- 3) Wastewater collection systems
 - a. House laterals
 - b. Street sewers
 - c. Trunk sewers
 - d. Interceptors
 - e. Manholes
 - f. Force mains
 - g. Depressed sewers (siphons)
 - h. Life stations
 - i. Cleaning and maintenance of collection systems
- 4) Individual treatment and disposal systems
 - a. Imhoff tanks
 - b. Septic tanks
 - c. Leach field systems
 - d. Seepage pits
 - e. Evapotranspiration and evapotranspiration-infiltration systems
 - f. Percolation beds
- 5) Preliminary treatment (screening, chemical conditioning)
 - a. Computation of chemical dosages
 - b. Grit removal: aerated and non-aerated quantities, disposal
 - c. Computation of detention times
- 6) Primary treatment
 - a. Sedimentation and flotation, theory
 - b. Removal efficiencies
 - c. Hydraulic loadings
 - d. Surface overflow rates
 - e. Weir overflow rates

- f. Tank design
 - g. Rectangular vs. circular configurations
 - h. Sludge and floatables removal
- 7) Computation and problem session for sedimentation and flotation units
- 8) Disinfection processes
- a. Chlorination, ozonation, ultraviolet, detention
 - b. Mechanisms (theory) of disinfection
 - c. Dosage rates
 - d. Detention times
 - e. Computations
- 9) Trickling filters
- a. Theory of operation
 - b. Roughing
 - c. Low and high rate filters
 - d. Hydraulic and organic loadings
 - e. Recirculation ratios
 - f. Treatment efficiencies
 - g. Applicability to various wastes
 - h. Computations
- 10) Activated sludge
- a. Theory of operation
 - b. Conventional activated sludge
 - c. Modified processes
 - d. Food to microorganism loadings
 - e. Air requirements
 - f. Sludge return and wasting
 - g. Removal efficiencies
 - h. Applicability to various wastes
 - i. Computations
- 11) Oxidation ponds
- a. Theory of operation
 - b. Aerobic ponds
 - c. Anaerobic ponds
 - d. Facultative ponds
 - e. Hydraulic and organic loadings
 - f. Efficiencies
 - g. Applicability
 - h. Computations

Course Objectives

Students will be able to:

- 1) List the agencies and locations of at least five wastewater treatment plants in the San Diego area.
- 2) Describe the basic principles and processes of conventional wastewater treatment plant operations, including preliminary, primary, secondary and tertiary treatment.
- 3) Explain the role Supervisory Control and Data Acquisition (SCADA) systems play in monitoring and operating wastewater treatment plants.
- 4) Describe workplace safety and health hazards common to wastewater treatment plants and list at least five key programs/procedures commonly employed to minimize these hazards.
- 5) Perform mathematical calculations common in solving problems related to the wastewater treatment process.

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) Participation in classroom discussions
- 2) Homework assignments
- 3) Quizzes and exams
- 4) 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. Giorgi, John. *Water Operator Certification Study Guide*, 6th edition. American Water Works Association, 2012.
 - b. Kerri, Kenneth D. *Operation of Wastewater Treatment Plants, Volume I*. 7th edition. CSU Sacramento Foundation, 2010.
- 2) Supplemental: None

Exit Skills

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

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

Student Learning Outcomes

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

- 1) Describe the importance of collection, treatment, and disposal of municipal wastewater.
- 2) Define and properly use wastewater treatment plant terminology.
- 3) Demonstrate a basic comprehension of the principles of operating conventional wastewater treatment plants.
- 4) Perform basic mathematical calculations and conversions relating to water flow, pressure, volume, velocity, chemical dosage, and hydraulic and organic loading as related to wastewater treatment plant operations.