San Bernardino Valley College
Curriculum Approved: 03/09/2015
Board Approval: 04/09/2015
Unique course Identification Number:
TOP Code: 0958.00 - Water and Wastewater Tech

I. CATALOG DESCRIPTION:

A. Department Information:
Division: Applied Technology, Transportation & Culinary Arts
Department: WATER SUPPLY TECHNOLOGY
Course ID: WST093
Course Title: Wastewater Treatment III
Units: 3
Lecture: 3 contact hour(s) per week
48 - 54 contact hours per semester

Prerequisite:
WST 092
Departmental Advisory:
WST 053

B. Catalog Description:

This is the third course in a series on wastewater treatment. It includes material usually found in the State Water Resources Control Board (SWRCB) grade III certificate examination.

C. Schedule Description:

This is the third course in a series on wastewater treatment. It includes material usually found in the State Water Resources Control Board (SWRCB) grade III certificate examination.

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. COURSE OBJECTIVES FOR STUDENTS:

Upon successful completion of the course the student should be able to:

A. Interpret federal and state laws and regulations as they relate to wastewater treatment processes
B. Demonstrate in writing an in-depth understanding of flow diagrams of typical treatment processes
C. Identify, evaluate, and suggest potential solutions for safety hazard applicable to wastewater treatment operations
D. Evaluate the performance and operation of various unit processes
E. Identify abnormal operation procedures including the application of laboratory results to process control, equipment and facilities maintenance

F. Identify and evaluate variations in conventional biological treatment systems
G. Calculate quantities of specific constituents in wastewater and describe their sources

IV. COURSE CONTENT:

A. Safety
    1. Rules and regulations
    2. Confined space
    3. Lock-out/tag-out procedure
    4. Chemical and biological hazards
    5. Hydrogen sulfide and oxygen deficiency
    6. Material Safety Data Sheet (MSDS)
    7. Employer Right-To-Know
    8. Chlorine safety
B. Communication, service and interpersonal relations
C. Wastewater treatment principles
    1. Regulations
        a. Infiltration and inflow (I & I)
        b. Biosolids
        c. Heavy metals
        d. Compatiable and non-compatiable wastes
    2. Wastewater sampling and analysis
    3. Flow monitoring and devices
    4. Trouble-shooting
    5. Process control strategies
D. Wastewater treatment processes
    1. Mechanical equipment
    2. Prelimary treatment
        a. Odor control
        b. Pre-aeration
        c. Flow equalization
        d. Chemical addition
    3. Primary sedimentation
    4. Biological processes
        a. Trickling filters
        b. Activated sludge (process modifications)
    5. Biological nutrient removal
        a. Nitrification
        b. Denitrification
    6. Chemical processes
        a. Phosphorus removal
        b. Nitrogen removal
    7. Physical processes-filtration
    8. Effluent disinfection
        a. Chlorination
        b. Ozonation
        c. Ultra-violet radiation
    9. Solids handling and disposal
        a. Sludge thickening
            i. Gravity thickner
            ii. Dissolved air floatation

iii. Gravity belt thickener
iv. Centrifuge
b. Sludge stabilization
i. Anaerobic digestion
ii. Aerobic digestion
c. Sludge dewatering
i. Centrifuge
ii. Belt press
iii. Drying beds

E. Evaluation of wastewater unit processes
F. Process start-up and shut-down
G. Solve wastewater related math problems
1. Pumping rate math
2. Pumping power
a. Horsepower
b. Water horsepower
c. Brake horsepower
d. Motor horsepower
3. Energy
a. Demand charges
b. Peak
c. Off-peak
d. Partial peak
e. Demand charges
4. Disinfection math
a. Chlorine dose, demand and residual
b. Chlorine storage and inventory
5. BOD testing and concentration calculations
6. Activated sludge process control calculations
a. Sludge volume index (SVI)
b. Wasting rate
c. Food to micro-organism ratio (F/M)
d. Mean cell residence time (MCRT)
e. Solids concentration in aeration tank
f. Return activated sludge
i. Solids balance approach
ii. Sludge settle-ability approach
7. Anaerobic digestion math
a. Solids testing in the laboratory
b. Percent total solids (%TS)
c. Percent volatile solids (%VS)
d. Percent fixed solids
e. Sludge calculations
f. Gallons of sludge removed
g. Pounds of volatile solids pumped
h. Percent volatile solids reduction
i. Percent seed sludge calculations
j. Volatile acid/alkalinity ratio
k. Organic loading rate
l. Gas production

8. Sludge thickening and dewatering calculations
    a. Percent concentration
    b. Solids loading rate
    c. Percent solid recovery
    d. Recycle flow rate
    e. Air to solids ratio

V. METHODS OF INSTRUCTION (May include any, but do not require all, of the following):

A. Lecture
B. Distributed education
C. Guest speakers
D. Class and/or small group discussion
E. Use of films, videotapes, or other media
F. Use of written materials: texts, journals, etc.
G. Classroom demonstrations
H. Guided practice
I. Instructor generated handouts

VI. TYPICAL OUT-OF-CLASS ASSIGNMENTS:

A. Reading assignments are required and may include (but are not limited to) the following:

1. Read the chapter on devices used for measuring flows in open channels. Be prepared to discuss, in class, the basic principles associated with open channel devices such as V-notch weirs and Parshall flumes.
2. Read the chapter on devices used for measuring flows in closed channels (full pipes). Be prepared to discuss, in class, the basic principles associated with the devices such as magnetic, turbine, Doppler and Venturi meters.

B. Critical thinking assignments are required and may include (but are not limited to) the following:

An activated sludge plant has a 50,000 gallon anaerobic digester which has been performing poorly since a recent increase in plant flow. Primary sludge flow is 2000 GPD @ 5% and secondary sludge is 5000 GPD @ 1%. Design criteria call for a maximum organic loading of 0.025 lbs VSS/cu.ft. and a detention time of not less than 15 days. Installation of a Dissolved Air Floatation (DAF) unit is being considered in order to thicken the sludge to 4.5 % density. Explain why you think the DAF unit will or will not solve the problem. Include in your answer a comparison of existing and proposed detention time and organic loadings.

C. Writing assignments are required and may include (but are not limited to) the following:

1. Describe an employer's responsibilities in implementing the right-to-know law, or Hazardous Substance Communication Program (HSCP).
2. It is time to clean a large digester that has been in service 8 years. The digester is in a

large metropolitan wastewater treatment facility using plant staff. Outline a comprehensive plan for the project, including disposal of grit and scum.
3. Describe various operating conditions resulting in foaming of activated sludge and routine methods for control.

VII. METHODS OF EVALUATION

A. Class participation
B. Examinations
C. Homework
D. Presentations (oral or visual)
E. Work performance (internships or field work)
F. Written papers or reports
G. Quizzes
H. Cumulative finals or certifications

VIII. TYPICAL TEXT(S):

Most current editions of the text books are listed. The books on this topic are usually published by industry trade groups and CSU Sacramento and are not updated frequently.

A. Kerri, Kenneth Advanced Wastewater Treatment Vol. 3. 7th ed. Kerri, Ken, 2008.
B. Kerri, Kenneth Operation of Wastewater Treatment Plants, Vol. II. 7th ed. California State University, Sacramento, 2008.
C. Water Environment Federation Operation of Municipal Wastewater Treatment Plant - MOP 11. 6th ed. WEF, 2007.

IX. OTHER SUPPLIES REQUIRED OF STUDENTS:

A. A scientific calculator