San Francisco State University
Civil Engineering

Course Outline for ENGR 435: Environmental Engineering Design

Spring 2017
Mondays/Wednesdays/Fridays- 9:10- 10:00 AM, HH 201

Professor Elahe Enssani, Ph.D., P.E, R.E.A.

Office Hours:
Wednesdays /Fridays 10:30 AM-11: 00 AM
& by appointment, Science Building 168A
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This outline and other class material will be available for download from ILearn.

Bulletin Description:
ENGR 435 Environmental Engineering Design (3)
Prerequisite: Chemistry 115
Introduction to conceptual design for cleaning up the environment using the fundamentals of
chemistry, physical chemistry, such as conservation of mass, conservation of energy, chemical
kinetics and microbial kinetics for degradation of pollutants. Concepts in water quality, process
design, process flow regimes will be taught through teaching the design of wastewater treatment
and biosolids digestion facilities. The students will take the class with only fresh person
chemistry and calculus II as the prerequisite. A review of water quality parameters, criteria and
wastewater characteristics will be done to familiarize the students with the concepts with
discussion on planning, design and construction of Infrastructure projects and their impact on the
environment through a review of California Environmental Quality Act (CEQA) and emerging
issues such as Financing to upgrade aging infrastructures through establishment of Infrastructure
Banks.

Textbooks (required):
1. Viessman, Jr., Warren and Mark J. Hammer . Water Supply and Pollution Control, 8th

2. Class Slides, download from ILearn

References (recommended):
1. Water Environment Federation and American Society of Civil Engineers Manual of
   Practice, Wastewater Treatment Plant Design. 1999. (On reserve in Dr. Enssani’s Office.
   You can check it out for two-hour use).
Coordinator:
Professor Elahe Enssani, PhD, PE, REA,

Prerequisites by Topic:
1. Basic chemistry: Chem 115 or Chem 180

Course Objectives*:
1. To learn fundamentals of conceptual process design and analysis. [A.2, A.4]
2. To learn the basic concepts in environmental engineering design. [B.1, B.2]
3. To gain an overview of the basic operations of wastewater/biosolids treatment systems. [B.1, B.4]

* indexes in brackets refer to Objectives and Outcomes of the School of Engineering.

Topics:
1. Introduction to Environmental Systems
2. Basic design considerations for Environmental systems
3. Fundamentals of Mass Balance
4. Fundamentals of Energy Balance
5. Review of Basic Chemistry as it relates to the environmental systems
6. Review of Basic Physical/Chemistry as it relates to the environmental systems
7. Review of Basic Chemical Kinetics as it relates to the environmental systems
8. Fundamentals of Process Design
9. Fundamentals of ideal flow regimes
10. Physical operations versus chemical processes in environmental design
11. Review of aquatic biology as it relates to environmental processes
12. Wastewater characterization, Oxygen Deficit equations
13. BOD, COD
14. Waste water treatment process design as example of process design
15. Primary Treatment
17. Biological treatment: Suspended Growth: Waste water treatment ponds
18. Biological treatment: Attached Growth: Trickling Filters
19. Sedimentation and sludge settling: Stokes’ law
20. Biosolids digestion: Anaerobic Biological Growth

Professional Component:
3 design units
**Evaluation:**
1. Exam I: 50-minute Exam ..................35%  Wednesday March 15
2. Exam II: 50-minute Exam ..................35%  Wednesday May 3
3. Weekly Homework assignments.............. 20%
4. Design Project.................................. 10%  Due Friday May 12
4. Class attendance and participation................. bonus points

**Please Note:** There is **NO Final Exam** in this class

**Performance Criteria**:  

**Objective 1**  
1.1 The student will demonstrate an ability to analyze simple environmental processes. [1, 2, 4]  
1.2 The student will demonstrate an ability to design simple environmental systems. [1, 2, 3, 4]

**Objective 2**  
2.1 The student will demonstrate a knowledge of the common environmental treatment systems’ design parameters such as suspended solids, BOD, etc. [1, 2, 3, 4]
2.2 The student will demonstrate a knowledge of the common water treatment processes such as filtration and color removal. [1, 2, 3, 4]
2.3 The student will demonstrate a knowledge of the design of the biological treatment systems. [1, 2, 3, 4]

**Objective 3**  
3.1 The student will demonstrate a knowledge in the anaerobic systems for wastewater and sludge. [2, 3, 4]  
3.2 The student will demonstrate an understanding of the differences between aerobic and anaerobic systems. [2, 4]
3.3 The student will demonstrate an understanding of the design and operational parameters for both anaerobic and aerobic systems. [2, 4]
3.4 The student will demonstrate an understanding of the analysis to obtain the operational concepts for both aerobic and anaerobic systems. [2, 4]

* Numbers in brackets refer to evaluation methods used to assess student performance.

**Homework Submittal, Homework Grading and Missed Exam Policy**

Weekly Homework assignments will be posted on ILearn and must be submitted promptly at the end of lecture on the designated due date (usually one week after posting). Solutions will be posted 5:00 PM of the due date on the web page. You should not plan to use lecture as a time to finish your homework. *Late homework will not be accepted.* Grading of homework will focus on evaluating effort and solution procedure, rather than the accuracy of numerical results. There will be no makeup exam.