

## Course Syllabus

<b>Course Description (4 Units)</b>	Engineering design of unit operations and unit processes for water and wastewater treatment, including: chemical coagulation, flocculation, sedimentation, filtration, and disinfection; preliminary, primary, secondary, tertiary, and advanced treatments; and processing and treatment of sludges.		
<b>Lecture</b>	Wednesday	6:30 – 9:50 pm	GFS 207 & Online
<b>Professor</b>	Wonho Warner Song, Ph.D., P.E., BCEE		
<b>Office</b>	Sanitation Districts of Los Angeles County 1955 Workman Mill Road Whittier, CA 90601 <a href="http://www.lacsd.org">www.lacsd.org</a>		
<b>Phone</b>	(562) 908 – 4288 x2822		
<b>Email</b>	<a href="mailto:wonhoson@usc.edu">wonhoson@usc.edu</a>		
<b>Office hours</b>	Wednesday 5:30 – 6:30 pm, KAP 200 (and also by appointment)		
<b>Prerequisites</b>	CE 453 Water Quality Science and Engineering CE 363L Water Chemistry and Analysis		
<b>Textbook</b>	Metcalf & Eddy / AECOM. Wastewater Engineering: Treatment and Resource Recovery, 5th Edition, McGraw-Hill, 2013 (ISBN 13: 978-0073401188, ISBN 10: 0073401188)		
<b>References</b>	Kawamura, Susumu. Integrated design and Operation of Water Treatment Facilities, Second Edition, John Wiley and Sons, Inc. 2000  WEF. Design of Municipal Wastewater Treatment Plants. WEF Manual of Practice No. 8 / ASCE Manual and Report on Engineering Practice No. 76. Fifth Edition, WEF Press / McGraw-Hill. 2010		
<b>Preparation Before Class</b>	Students are required to download and preview class materials prior to class. Reading assignments will be made from the textbook and the lecture notes posted on Blackboard.		
<b>Learning Objectives</b>	<ul style="list-style-type: none"> <li>▪ To apply knowledge of physics, chemistry, microbiology, and fluid mechanics to perform engineering analysis and design calculations for water and wastewater treatment systems.</li> <li>▪ To equip student with a broad theoretical and practical foundation needed to provide comprehensive and cost-effective design and operation of water and wastewater treatment systems.</li> </ul>		
<b>Grading Criteria</b>	Midterm 1	20%	
	Midterm 2	20%	
	Final Exam	25%	
	Design Project	25%	
	Homework	10%	
<b>Policies on Late Work</b>	Late assignments will be docked 10% for each day late to maximum of 50%. Late design projects will be reduced in grade.		

<b>Schedules for Exams, Quizzes, and Projects</b>	Midterm 1 Midterm 2 60% Design Project Due 100% Design Project Due Final Exam	Sep. 16, 2020 Oct. 21, 2020 Oct. 28, 2020 Nov. 18, 2020 Nov. 18, 2020
<b>Grading Scale</b>	Course final grades will be determined using the following scale	
	A 92-100 A- 88-91 B+ 84-87 B 80-83 B- 76-79 C+ 72-75 C 68-71 C- 64-67 D+ 60-63 D 56-59 D- 52-55 F 51 and below	

**WEEKLY SCHEDULE**

Week No.	Date	Topic	Reading Assign	HW
<b>Week 1</b>	8/19	<b>Design Project Management</b> <b>Drinking Water Standards</b> <b>Chemical Systems</b>	<b>Lecture Note</b>	HW 1 Due 8/26
<b>Week 2</b>	8/26	<b>Coagulation</b> <b>Flash Mixer Design</b> <b>Flocculation Design</b> <b>Sedimentation Design</b>	<b>Chap 6 Lecture Note</b>	HW 2 Due 9/2
<b>Week 3</b>	9/2	<b>Filtration Design</b> <b>Disinfection</b> <b>Water Treatment Plant Mass Balance</b>	<b>Chap 11</b> <b>Chap 12</b>	HW 3 Due 9/9
<b>Week 4</b>	9/9	<b>Introduction to Wastewater Treatment</b> <b>Wastewater Characteristics</b> <b>Wastewater Flowrates and Constituent Loadings</b>	<b>Chap 1</b> <b>Chap 2</b> <b>Chap 3</b>	HW 4 Due 9/16
<b>Week 5</b>	9/16	<b>Midterm 1</b> <b>Wastewater Flowrates and Constituent Loadings</b> <b>Design Project Overview 1</b>	<b>Chap 3</b>	HW 5 Due 9/30

Week No.	Date	Topic	Reading Assign	HW
Week 6	9/23	Process Selection, Design, and Implementation Physical Unit Processes	Chap 4 Chap 5	HW 6 Due 10/7
Week 7	9/30	Fundamentals of Biological Treatments Identifying Team Members	Chap 7	HW 7 Due 10/7
Week 8	10/7	Suspended Growth Biological Treatment Processes	Chap 8	HW 8 Due 10/14
Week 9	10/14	Suspended Growth Biological Treatment Processes Attached Growth and Combined Biological Treatment	Chap 8 Chap 9	HW 9 Due 10/21
Week 10	10/21	Midterm 2 Design Project Overview 2		HW 10 Due 10/28
Week 11	10/28	Separation Processes for Residual Constituents Removal Plant Hydraulics 60% Design Project Due	Chap 11 Lecture Note	HW 11 Due 11/4
Week 12	11/4	Processing and Treatment of Sludges Biosolids Processing, Recovery and Beneficial Use Wastewater Treatment Plant Mass Balance Design Project Overview 3	Chap 13 Chap 14 Lecture Note	HW 12 Due 11/11
Week 13	11/11	Biological Enhanced Phosphorous Removal Air Emissions from Treatment Facilities and Their Control 100% Design Project Due	Lecture Note Chap 16	
Week 14	11/18	Final Exam		

- Exams are denoted in red.
- Design projects are denoted in green.
- Topics and textbook chapter numbers are denoted in blue.

## DESIGN PROJECT

### 1. Project Objective

The purpose of the class project is to practice the fundamentals for the design of wastewater treatment plant. A design team that is consisted of 2 students will provide preliminary design services for improvements to the existing wastewater treatment facility. The preliminary design report should describe how the upgraded plant will produce a plant effluent that will meet the regulatory requirements.

### 2. Project Time Line

- Week 5: Design Project Overview 1
- Week 6: Identifying Team Members
- Week 9: Design Project Overview 2
- Week 10: 60% Preliminary Design Report Due
- Week 12: Design Project Overview 3
- Week 13: 100% Preliminary Design Report Due

### 3. Design Components

- Headworks
- Grit removal facility
- Primary clarifier
- Biological nutrient removal system
- Secondary clarifier
- RAS/WAS pumping system
- Tertiary filter
- Disinfection facility
- Sludge treatment facility (WAS thickening, digestion, and dewatering)

### 4. Preliminary Design Submittal Requirements

- Cover page
- Table of contents
- Memorandum
- Process flow diagram (PFD)
- Tabular presentations of design criteria for the proposed facilities
- Constituent mass loadings
- Design calculations for the proposed and the existing facilities
- Pipe sizing table showing the pipe label, number of parallel pipe, flowrate per pipe, and pipe diameter, and flow velocity
- General site layout with yard piping
- Mass balance for BOD and TSS under monthly peak conditions
- Plant Hydraulic Profile

5. Evaluation Factors (Grades will be assigned based on the following factors)

- Memorandum (10%)
- Design Calculations (10%)
- Proposed Plant Design Criteria Table (10%)
- Process Flow Diagram (10%)
- Pipe Sizing (10%)
- Site Layout (10%)
- Hydraulic Profile (10%)
- Mass Balance (10%)
- Overall Format and Neatness (10%)
- Collaborative Teamwork (10%)

### Statement on Academic Conduct and Support Systems

#### Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” [policy.usc.edu/scampus-part-b](http://policy.usc.edu/scampus-part-b). Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, [policy.usc.edu/scientific-misconduct](http://policy.usc.edu/scientific-misconduct).

#### Support Systems:

*Student Health Counseling Services - (213) 740-7711 – 24/7 on call*  
[engemannshc.usc.edu/counseling](http://engemannshc.usc.edu/counseling)

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

*National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call*  
[suicidepreventionlifeline.org](http://suicidepreventionlifeline.org)

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

*Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call*  
[engemannshc.usc.edu/rsvp](http://engemannshc.usc.edu/rsvp)

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

*Office of Equity and Diversity (OED) | Title IX - (213) 740-5086*

[equity.usc.edu](http://equity.usc.edu), [titleix.usc.edu](http://titleix.usc.edu)

Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

*Bias Assessment Response and Support - (213) 740-2421*

[studentaffairs.usc.edu/bias-assessment-response-support](http://studentaffairs.usc.edu/bias-assessment-response-support)

Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

*The Office of Disability Services and Programs - (213) 740-0776*

[dsp.usc.edu](http://dsp.usc.edu)

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

*USC Support and Advocacy - (213) 821-4710*

[studentaffairs.usc.edu/ssa](http://studentaffairs.usc.edu/ssa)

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

*Diversity at USC - (213) 740-2101*

[diversity.usc.edu](http://diversity.usc.edu)

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

*USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu), [emergency.usc.edu](http://emergency.usc.edu)

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

*USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu)

Non-emergency assistance or information.