**CE 485 Water Treatment Design**  
2019 Fall – Course Syllabus

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Wednesday 6:30 – 9:50 pm</th>
<th>KAP 167</th>
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</thead>
<tbody>
<tr>
<td>Professor</td>
<td>Wonho Warner Song, Ph.D., P.E., BCEE</td>
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</table>
| Office | Sanitation Districts of Los Angeles County  
1955 Workman Mill Road  
Whittier, CA 90601  
www.lacsd.org |
| Phone | (562) 908 – 4288 x2822 |
| Email | wonhoson@usc.edu |
| Office hours | Wednesday 5:30 – 6:30 pm, KAP 200 (and also by appointment) |

**Prerequisites**  
CE 453 Water Quality Science and Engineering  
CE 363L Water Chemistry and Analysis

**Textbook**  

**References**  

**Preparation Before Class**  
Presentation materials, assignments, and supplementary class notes will be posted on Blackboard. Students are required to download and preview class materials prior to class. Reading assignments will be made from the textbook and the lecture notes.

**Course Description**  
Engineering design of unit operations and unit processes for water and wastewater treatment.

**Learning Objectives**  
- To apply knowledge of physics, chemistry, microbiology, and fluid mechanics to perform engineering analysis and design calculations for water and wastewater treatment systems.  
- 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.

**Grading Criteria**  
<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Midterm Exam</td>
<td>25%</td>
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<tr>
<td>Final Exam</td>
<td>30%</td>
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<tr>
<td>Design Project</td>
<td>20%</td>
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<tr>
<td>Quizzes</td>
<td>15%</td>
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<tr>
<td>Homework</td>
<td>10%</td>
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**Policies on Late Work**  
Late assignments will be docked 10% (of the percent correct) for each day late to maximum of 50%. Late design projects will be reduced in grade.
### Schedules for Exams, Quizzes: and Projects

<table>
<thead>
<tr>
<th>Quiz 1</th>
<th>Sep 18, 2019</th>
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<tbody>
<tr>
<td>Midterm</td>
<td>Oct 16, 2019</td>
</tr>
<tr>
<td>60% Design Project Due</td>
<td>Nov 6, 2019</td>
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<tr>
<td>Quiz 2</td>
<td>Nov 13, 2019</td>
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<tr>
<td>100% Design Project Due</td>
<td>Dec 4, 2019</td>
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<tr>
<td>Final Exam</td>
<td>Dec 11, 2019</td>
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### Grading Scale

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

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Date</th>
<th>Topic</th>
<th>Reading Assign</th>
<th>HW</th>
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</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>8/28</td>
<td><strong>Design Project Management</strong></td>
<td>Lecture Note</td>
<td>HW 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Preliminary Studies</td>
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<td>Due 9/4</td>
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<td><strong>Drinking Water Standards</strong></td>
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<tr>
<td>Week 2</td>
<td>9/4</td>
<td><strong>Chemical Systems</strong></td>
<td>Chap 6 Lecture Note</td>
<td>HW 2</td>
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<tr>
<td></td>
<td></td>
<td>Coagulation</td>
<td></td>
<td>Due 9/11</td>
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<tr>
<td></td>
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<td>Flash Mixer Design</td>
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<tr>
<td>Week 3</td>
<td>9/11</td>
<td><strong>Flocculation Design</strong></td>
<td>Lecture Note</td>
<td>HW 3</td>
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<td>Sedimentation Design</td>
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<td>Due 9/18</td>
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<td></td>
<td></td>
<td>Filtration Design</td>
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<tr>
<td>Week 4</td>
<td>9/18</td>
<td><strong>Quiz 1</strong></td>
<td>Chap 11</td>
<td>HW 4</td>
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<tr>
<td></td>
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<td>Filtration Design</td>
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<td>Due 9/25</td>
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<tr>
<td>Week 5</td>
<td>9/25</td>
<td><strong>Disinfection</strong></td>
<td>Chap 12 Lecture Note</td>
<td>HW 5</td>
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<td><strong>Water Treatment Plant Mass Balance</strong></td>
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<td>Due 10/2</td>
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<tr>
<td>Week No.</td>
<td>Date</td>
<td>Topic</td>
<td>Reading Assign</td>
<td>HW</td>
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| Week 6   | 10/2  | **Introduction to Wastewater Treatment**  
**Wastewater Characteristics**  
**Design Project Overview 1** | Chap 1 Chap 2   | HW 6 Due 10/9 |
| Week 7   | 10/9  | **Wastewater Flowrates and Constituent Loadings**  
**Process Selection, Design, and Implementation**  
**Physical Unit Processes** | Chap 3 Chap 4 Chap 5 | HW 7 Due 10/16 |
| Week 8   | 10/16 | **Midterm Exam**  
**Physical Unit Processes** | Chap 5          | HW 8 Due 10/23 |
| Week 9   | 10/23 | **Fundamentals of Biological Treatments**                            | Chap 7         | HW 9 Due 10/30 |
| Week 10  | 10/30 | **Suspended Growth Biological Treatment Processes**                  | Chap 8         | HW 10 Due 11/6 |
| Week 11  | 11/6  | **Suspended Growth Biological Treatment Processes**  
**Attached Growth and Combined Biological Treatment**  
**Separation Processes for Residual Constituents Removal**  
**60% Design Project Due** | Chap 8 Chap 9 Chap 11 | HW 11 Due 11/13 |
| Week 12  | 11/13 | **Quiz 2**  
**Plant Hydraulics** | Lecture Note    | HW 12 Due 11/20 |
| Week 13  | 11/20 | **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 13 Due 12/4 |
| Week 14  | 11/27 | **Thanksgiving holiday**                                             | Lecture Note    | -            |
| Week 15  | 12/4  | **100% Design Project Due**  
**Biological Enhanced Phosphorous Removal**  
**Air Emissions from Treatment Facilities and Their Control** | Lecture Note Chap 16 | -            |
| Week 16  | 12/11 | **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 6: Design Project Overview 1
   - Week 7: Identifying Team Members
   - Week 10: Design Project Overview 2
   - Week 11: 60% Preliminary Design Report Due
   - Week 13: Design Project Overview 3
   - Week 15: 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%)
- PFD (10%)
- Pipe Sizing (10%)
- Site Layout (10%)
- Hydraulic Profile (10%)
- Mass Balance (10%)
- Overall Format and Neatness (10%)
- Overall Effort (10%)

STATEMENT ON ACADEMIC INTEGRITY

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one’s own academic work from misuse by others as well as to avoid using another’s work as one’s own.

All students are expected to understand and abide by these principles. SCampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: http://www.usc.edu/dept/publications/SCAMPUS/gov/.

Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/.

STATEMENT FOR STUDENTS WITH DISABILITIES

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible.

DSP Contact Information

Office location: STU 301
Hours open: 8:30 a.m. until 5:00 p.m. — Monday through Friday.
Phone number: (213) 740-0776