### Rubric

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<th>Title of Course</th>
<th>Course Instructor</th>
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<tr>
<td>CIVL 3420</td>
<td>Guanghao CHEN</td>
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<tr>
<td>Water and Wastewater Engineering</td>
<td>Richard C. CHAN</td>
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<tr>
<td>Lab Instructor</td>
<td>Lin CHEN, Weiqi XUE, Dao GUAN, Guo GANG, Muhammad Ahmar SIDDIQUI</td>
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### Prerequisite(s)
- CIVL 2410 (Environmental Engineering and Management) or CIVL 1140 (Environmental Quality Control and Improvement)

### Credits
- 3

### Textbook(s) and/or Other Materials

**Textbook**

**Reference Books**

**References for the Laboratory Section**

### Course Objectives

1. Provides students the fundamental knowledge in the engineering principles for development, design, and operation/maintenance of typical unit operations for water and wastewater treatment systems.
2. Familiarize students with the basic concepts and design approaches related to both water and wastewater treatment processes.
3. Expose students to real projects and case studies which demonstrate the applications of the engineering principles and design considerations in reality.
4. Introduce students the cutting edge research relevant to the subject.

### Topics

1. **Overview of Water and Wastewater Treatments**
   - 1.1 Sources for water supply and drinking water standards
   - 1.2 Typical water treatment processes and supply systems
   - 1.3 Municipal sewage characteristics and discharge regulations
   - 1.4 Typical sewage treatment processes
   - 1.5 Basic of water and wastewater engineering

2. **Key Process/Unit Operation in Water Treatment Systems**
   - 2.1 Disinfection
   - 2.2 Coagulation and flocculation
   - 2.3 Sedimentation
   - 2.4 Filtration

3. **Key Process in Wastewater Treatment Systems**
   - 3.1 Basic concepts of the 2nd treatment
   - 3.2 Mass transfer and aeration
   - 3.3 Suspended growth processes
   - 3.4 Attached growth processes

4. **Sludge Treatment and Disposal**
   - 4.1 Sludge treatment processes
   - 4.2 Sludge final disposal or reuse

### Computer Usage
- To be advised by the lecturers
| Lab Projects | LP 1: Water Quality Assessment  
LP 2: Jar Test (under revision and will be upgraded to unit operations practices: coagulation-flocculation-sedimentation in Spring 2017)  
LP 3: Bioreactor treatment efficiency – BOD₅ and COD Tests. |
| Class/Lab Schedule | Two 80-minute lectures with one 50-minute tutorial and 3-hour lab per week |
| Contribution to the professional component | 100% engineering topics |
| Intended Learning Outcomes (ILOs) of this course | On successful completion of this course, students are expected to be able to:  
1. utilize fundamental knowledge in mathematics, physics, chemistry and biology that governs water and waste treatment processes  
2. comprehend the engineering principles for development, design, and operation/maintenance of typical water and wastewater treatment units and/or systems.  
3. familiarize with the basic concepts and design approaches related to water and wastewater treatment processes.  
4. conduct experiments and interpret results for water and wastewater engineering analysis and/or design.  
5. formulate problems and propose feasible solutions to apply engineering principles and design considerations in real projects and case studies.  
6. enrich with pressing issues and cutting edge research relevant to water and wastewater treatment |
| Relationship to the Program Objectives | PEO1. Provide students with professional skills in the design, construction and management of the civil infrastructure, as well as an awareness of environmental sustainability.  
This course provides the fundamental knowledge in the engineering principles for development, design, and operation/maintenance of typical water and wastewater treatment units and system, and the basic concepts and design approaches related to both water and wastewater treatment processes (ILO#1, 2, 3, 4).  
PEO4. Expose students to real world engineering projects and cutting edge research to improve their understanding of the profession and technological advancements that can improve current practice.  
The course discusses real projects and case studies to demonstrate the applications of the engineering principles and design considerations in reality. The course materials are also updated yearly to include cutting edge research relevant to the subject (ILO#5, 6). |
| Relationship to program outcomes | PO1. Acquire fundamental knowledge in mathematics and science on which civil and environmental engineering research and practice are based.  
PO2. Understand fundamental principles of engineering science relevant to civil and environmental engineering disciplines.  
PO3. Acquire an ability to conduct experiments, analyze and interpret results, and appreciate the importance of experimental data in establishing empirical relationships and parameters for analysis and design.  
PO4. Acquire an ability to apply modern engineering tools effectively and efficiently for engineering analysis, design and communication.  
PO5. Develop an ability to identify and formulate civil and environmental engineering problems and propose feasible solutions with an appreciation of their underlying assumptions, uncertainties, constraints, and technical limitations. |
| PO6. Develop technical competency to design civil and environmental engineering components and systems, with an understanding of the principles behind the design methodologies. |
| PO8. Obtain in-depth knowledge in the area of environmental engineering. |
| PO9. Develop an ability to communicate and present ideas effectively, including oral, written, and technical writing skills, and to function effectively within and among teams with a variety of backgrounds and interests. |
| PO10. Recognize the importance of seeking further specialization within civil and environmental engineering and the need for life-long learning. |
| PO11. Instill a deep sense of professional responsibilities and the importance of ethical and societal considerations, including public health, safety, environmental conservation, welfare etc. |
| PO12. Develop an ability to stay abreast of contemporary issues, both nationally and internationally, and the awareness of the impact of engineering in these areas. |

| Assessment of Outcomes | 5 out of 9 assigned homework (20% total), three lab reports (30%) and a final exam (50%) |
| Prepared by | Guanghao CHEN  |
|              | Richard C. CHAN |