Course Code Course Title Course Instructor Lab. Instructor Teaching Assistants	CIVL 3420 **Water and Wastewater Engineering** Prof. CHEN Guanghao Prof. CHEN Guanghao Mr. LIU Yuanjun Ms. SIRIWEERA Withanage Buddhima Sharmane
Prerequisite(s) Credits	CIVL 2410 (Environmental Engineering and Management) or CIVL 1140 (Environmental Quality Control and Improvement) 3
Textbook(s) and/or Other Materials	**Text Book** Droste, R.L (2019). Theory and Practice of Water and Wastewater Treatment, Second edition, John Wiley & Sons, New York. **Recommended Books** 1. Crittenden, J.C. et al. (2005). Water Treatment: Principles and Design. John Wiley & Sons, New York. 2. Tchobanoglous, G. et al. (2004). Wastewater Engineering: Treatment, Disposal, Reuse. Metcalf & Eddy, Inc., McGraw-Hill, New York. **References for the Laboratory** 1. APHA, AWWA, and WEF (American Public Health Association, American Water Works Association, and Water Environment Federation). (1998). Standard Methods for the Examination of Water and Wastewater. 20thed. M. A. Franson (Ed). American Public Health Association, Washington. DC. 2. Keith, L. H. (1996). Principles of Environmental Sampling. 2nded. American Chemical Society, Washington, DC.
Course Objectives	By the end of this course, students will be able to: 1. Understand the whole process from water supply to wastewater treatment and the respective regulations; 2. Describe the characteristics of supplied water and the municipal sewage and the typical unit processes used in water and wastewater treatment; 3. Understand the principle of the physicochemical and biological treatments; 4. Explain the key parameters to design the water, and wastewater treatment units are; 5. Develop basic lab skills for environmental engineering, and learn how to analyze and interpret results.
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 water and wastewater engineering 2. Key Process/Unit Operation in Water Treatment Systems 2.1 Coagulation and flocculation 2.2 Sedimentation 2.3 Filtration 2.4 Disinfection 3. Key Process/Unit Operation in Wastewater Treatment Systems 3.1 Basic concepts of the secondary treatment 3.2 Activated sludge processes 3.3 Attached growth process 3.4 Sludge treatment and disposal (optional)
Computer Usage	To be advised by the lecturers

Lab Projects	LP 1: Water Quality Assessment LP 2: Coagulation, Flocculation, and Sedimentation. LP 3: Bioreactor treatment system demonstration.
Class/Lab Schedule	Two 80-min lectures per week, one 50-mins homework tutorial after homework is released, and three labs during the semester.
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 the 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 civil infrastructure, as well as an awareness of environmental sustainability.* This course provides the fundamental and principal concepts and design approaches for the development and operation/maintenance of typical water and wastewater treatment units and systems. *PEO2. Expose students to real-world engineering projects and cutting-edge research to improve their understanding of the profession and technological advancements to improve current practice.* The course discusses real projects and case studies to demonstrate the applications of engineering principles and design considerations for real practice. The course materials are updated yearly to include cutting-edge research relevant to the subject.
Relationship to program outcomes	*PO1. Acquire fundamental knowledge in mathematics and science on which civil and environmental engineering research and practice are based.* This course exposes students to the basic principles of physicochemical and biological water and wastewater treatment processes and helps students learn the calculations for the unit process designs. *PO2. Understand fundamental principles of engineering science relevant to civil and environmental engineering disciplines.* This course helps students to understand 1) the characteristics of supplied water and municipal sewage and the typical unit processes used in water and wastewater treatment; 2) the principles of the physicochemical and biological treatments. *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.* This course help students to develop basic lab skills for environmental engineering and learn how to analyze and interpret results.

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<tr><td></td><td>PO4. Develop technical competency to design civil and environmental engineering components and systems, understanding the principles behind the design methodologies.
This course explains the key parameters to design the water and wastewater treatment units, and students can gain design experience from the example design problems.

PO5. Recognize the importance of seeking further specialization within civil and environmental engineering and the need for life-long learning.
This course covers physicochemical and biological treatment knowledge, which can help students discover their interests for future studies.</td></tr>
<tr><td>Assessment of Outcomes</td><td>Four assigned homework (20% total), three lab reports/quizzes (30%), and a final exam (50%)

Summary of Assessment Activities on Course Outcomes
<table>
<tr><th>ILOs</th><th>Learning Activity</th><th>Assessment</th></tr>
<tr><td>1</td><td>Lecture, Laboratory, Tutorial</td><td>Homework, Lab Report, Final Exam</td></tr>
<tr><td>2</td><td>Lecture, Laboratory, Tutorial</td><td>Homework, Lab Report, Final Exam</td></tr>
<tr><td>3</td><td>Lecture, Laboratory, Tutorial</td><td>Homework, Lab Report, Final Exam</td></tr>
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<tr><td>6</td><td>Lecture, Laboratory, Tutorial</td><td>Homework, Lab Report, Final Exam</td></tr>
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<tr><td>Prepared by</td><td>Prof. CHEN Guanghao
Spring 23/24</td></tr>
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