Subject Description Form

Subject Code	CSE49461
Subject Title	Water and Wastewater Treatment Techniques
Credit Value	3
Level	4
Pre-requisite / Co-requisite/ Exclusion	Exclusions: CSE30461 Water and Wastewater Treatment Techniques for ESD or CSE461 Water and Wastewater Treatment Techniques or CSE40461 Water and Wastewater Treatment Techniques for Civil Engineering
Objectives	(1) To provide basic knowledge on water and wastewater treatment technologies for water supply and wastewater disposal in Hong Kong; and (2) To provide practical laboratory works to familiarize with the treatment technique for water, sewage and sludge treatment.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. apply the fundamental knowledge of water and wastewater treatment processes and engineering concepts to formulate effective solutions to environmental engineering problems relevant to water supply and wastewater disposal in Hong Kong; b. identify, structure and analyze diverse problems arising from the changing constraints that influence engineering projects, such as environmental, legislative, sustainability, and technological considerations; c. offer the employers in Hong Kong a useful contribution to design and operations of water and wastewater treatment works; d. work with others in group work, and take responsibility for an agreed area of shared activities; and e. have critical and creative thinking and an ability to work independently.
Subject Synopsis/ Indicative Syllabus	1.<u>Water Treatment Operations and Processes (6 weeks)</u> Kinetics of Treatment Processes (Reaction rates and order, effect of pH and temperature on reaction rates, kinetics of biological growth); Sedimentation Processes (Discrete particle settling, flocculent settling, zone settling and compaction and their applications in water and wastewater treatment; Coagulation and Flocculation (Coagulants, mechanisms of coagulation and flocculation, dosage requirements and flocculators); Filtration Processes (Filter hydraulics, slow sand and rapid gravity filtration, direct filtration, filter backwashing) 2. <u>Wastewater Treatment Operations and Processes (6 weeks)</u> Operational principle and basic technique of wastewater treatment processes-pumping, screening, grit removal,

comminution, flow measurement, primary sedimentation, activated sludge process and its variants, biological filtration and RBC, final sedimentation, disinfection; advanced wastewater treatment technique including filtration, carbon adsorption, chemical precipitation and nitrogen and phosphorous removal; eff1uent discharge and reuse.

3. Treatment and Disposal of Sludge (1 week)
Characteristics of alum sludge and wastewater sludge, quantity of sludges; Principle and technique of sludge treatment processes-thickening, stabilisation, conditioning and dewatering; sludge disposal and utilization.
4. Laboratory Works
Jar test, E. Coli enumeration, Chlorination breakpoint, Activated sludge and sludge characteristics.

Teaching/Learning Methodology

In the lectures, fundamental knowledge relating to the theoretical processing, operation and treatment technique of water purification and wastewater treatment systems will be established. Students will be required to undertake various coursework activities, which will enable them to thoroughly digest the taught materials. Tutorials will provide opportunities for students and lecturers to communicate and discuss any difficulties relating to the lectures. It will also provide a forum for students and lecturer to discuss the ongoing coursework and laboratory activities. Video-show in tutorial sessions and the site visit develop students' interest and motivation for learning.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Assignments	15	√	√	√	√	√
2. Laboratory Reports	7.5	√	√		√	√
3. Tests	7.5	√	√			√
4. Examination	70	√	√			√
Total	100					

Students must pass the final examination and achieve a passing overall score/ grade to pass the subject.

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

(1) Assignments based on calculations and designs of water and wastewater treatment technique, and familiarize with diverse engineering problems;
(2) Laboratory works and report writing will enable students to familiarize with practical experiment and in-depth understanding of the technique involved in water and

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<tr><td></td><td colspan="2">wastewater treatment, as well as training for group work and sharing individual responsibility; and
(3) Test and examination can attribute critical and creative thinking for independent work and ability to carry out water and wastewater techniques for design and solving environmental engineering problems on operation.</td></tr>
<tr><td rowspan="7">Student Study Effort Expected</td><td></td><td></td></tr>
<tr><td>Class contact:</td><td>Average hours per week</td></tr>
<tr><td>▪ Lectures/ Tutorials/ Laboratory</td><td>3 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Reading and Studying</td><td>3 Hrs.</td></tr>
<tr><td>▪ Completion of Assignment/Design project/Lab. Reports</td><td>3 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>9 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2">Reading

1. Mark J. Hammer, Water and Wastewater Technology, 5th edition, Prentice Hall, 2003.
2. John C. Crittenden R,Rhodes Trussell, David W. Hand, Kerry J. Howe, George Tchobanoglous, MWH's Water Treatment: Principles and Design, Third Edition, 2012
3. Metcalf & Eddy, Wastewater Engineering-Treatment and Resource Recovery; Fifth Edition, McGraw-Hill, 2014

Reference

1. Mackenzie L. Davis, Susan J. Masten., Principle of Environmental Engineering & Science, 2nd Ed., McGraw-Hill, 2009.
2. Mackenzie L. Davis and David A. Cornwell, Introduction to Environmental Engineering, McGraw-Hall International Editions, 2008.
3. Eckenfelder, W.W. Jr., Industrial Water Quality, McGraw-Hill, 2009.
4. Mackenizie L. Davis, David A. Cornwell., Introduction to Environmental Engineering, McGraw-Hill, 2008.</td></tr>
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