City University of Hong Kong
Course Syllabus

offered by School of Energy and Environment
with effect from Semester A 2017/18

Part I Course Overview

Course Title:	Advanced Treatment and Management of Solid and Municipal Waste
Course Code:	SEE4203
Course Duration:	1 semester
Credit Units:	3 credits
Level:	B4
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	SEE4217 Waste and Wastewater Treatment Engineering
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

(A 150-word description about the course)

This course aims to provide students with up-to-date knowledge regarding ever-growing and intricate problems of managing and processing the waste due to urban development. It covers issues concerning economic, legislative and regulatory development involved in the management of solid waste and technology including waste collection, transfer, recycling, waste-to-energy, incineration, hazardous waste management and landfill disposal. Students will be able to design an integrated waste management system for source reduction and disposal by combining the available options. Life-cycle assessment (LCA) in making engineering decisions will be discussed.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs[#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Explain solid waste generation and management in a technological society and generalize integrated solid waste management economics, legislation, and material flow concepts	20%	√		
2.	Analyse physical, chemical, and biological properties of municipal solid waste and evaluate available biological and thermal treatment technologies	25%		√	
3.	Assess waste collection system to sanitary landfill planning for final disposal of municipal solid waste	25%		√	
4.	Apply LCA approach in making decisions to design an integrated solid and hazardous waste management system	30%	√	√	
		100%			

** If weighting is assigned to CILOs, they should add up to 100%.*

[#] Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

A3: *Accomplishments*
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
Lecture	Explain the key concept of solid and hazardous waste management, treatment technologies, and non-technical issues including regulation, economic analysis and ethics	√	√	√	√	
Field visit	Visits to nearby recycling plants, and MSW landfill facilities	√	√	√	√	
Case study	Introduction of latest incineration, energy recovery, solid waste recycling and regulatory policy and technologies	√	√	√	√	
Project presentation	Conduct life-cycle assessment (LCA) and economic analysis to understand the decision making processes to design the integrated solid waste management system	√	√	√	√	

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.				Weighting*	Remarks
	1	2	3	4		
Continuous Assessment: __60__%						
In class test	√	√	√		20%	
Assignment	√	√	√		10%	
Project presentation	√	√	√	√	30%	
Examination: __40__% (duration: 2 hrs , if applicable)						
** The weightings should add up to 100%.*					100%	

Examination duration: 2 hrs
Percentage of coursework, examination, etc.: 60% by coursework; 40% by exam

To pass a course, a student must do ALL of the following:

1) obtain at least 30% of the total marks allocated towards coursework (combination of assignments, pop quizzes, term paper, lab reports and/ or quiz, if applicable);
2) obtain at least 30% of the total marks allocated towards final examination (if applicable); and
3) meet the criteria listed in the section on Assessment Rubrics.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. In-class test	Ability to design and analyse different thermal and biological processes for the treatment of MSW	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Assignment	Ability to evaluate the heat value analysis on different combustion and incineration technologies	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Project	Ability to conduct LCA and economic analysis, to demonstrate the decision making process to the problem of MSW management	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Final exam	Ability to provide engineering solutions and to design an integrated waste management system for source reduction and disposal by combining the available options	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

- Integrated Solid Waste Management: economics, legislation and regulations; material flow (reduction, reuse, recycling, recovery, energy conversion and disposal)
- Processing of Municipal Solid Waste
- Combustion (Incineration) and Energy Recovery
- Biochemical Process (Compositing)
- Landfills
- Hazardous Solid Waste
- Economic Issues in Solid Waste Management: Life cycle analysis and management; environmental justice; ethics and role of the engineers

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	WORRELL W.A. and VESILIND P.A. (2012) Solid Waste Engineering, 2nd ed. Connecticut: Cengage Learning.
2.	TCHOBANOGLOUS, G. and KREITH, F. (2002) Handbook of Solid Waste Management. New York: McGraw-Hill, Ltd.

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	BAGCHI, A. (2004) *Design of Landfills and Integrated Solid Waste Management, 3rd ed.* New Jersey: John Wiley & Sons, Ltd
2.	HAAS, C.H. and VAMOS, R.J. (1995) Hazardous and Industrial Waste Treatment. New Jersey: Pearson Prentice Hall.
3.	CHRISTENSEN, T. (ed.) (2010) Solid Waste Technology & Management. New Jersey: John Wiley & Sons, Ltd.
4	http://www.epd.gov.hk/epd/english/environmentinhk/waste/waste_maincontent.html
5.	Hong Kong BLUEPRINT FOR SUSTAINABLE USE OF RESOURCES 2013 – 2022 http://www.enb.gov.hk/en/files/WastePlan-E.pdf