

Course Syllabus

**offered by Department of Chemistry
with effect from Semester A 2020/21**

This form is for the completion by the Course Leader. The information provided on this form is the official record of the course. It will be used for the City University's database, various City University publications (including websites) and documentation for students and others as required.

Please refer to the Explanatory Notes on the various items of information required.

Prepared / Last Updated by:

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**City University of Hong Kong
Course Syllabus**

**offered by Department of Chemistry
with effect from Semester A 2020/21**

Part I Course Overview

Course Title:	Biological Treatment of Wastes
Course Code:	CHEM4023 (and CHEM4023A)
Course Duration:	1 semester
Credit Units:	4 (3) credits
Level:	B4
Proposed Area: <i>(for GE courses only)</i>	<input type="checkbox"/> Arts and Humanities <input type="checkbox"/> Study of Societies, Social and Business Organisations <input type="checkbox"/> Science and Technology
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: <i>(Course Code and Title)</i>	Nil
Precursors: <i>(Course Code and Title)</i>	Nil
Equivalent Courses: <i>(Course Code and Title)</i>	BCH4023 (and BCH4023A) Biological Treatment of Wastes
Exclusive Courses: <i>(Course Code and Title)</i>	CHEM4034/BCH4034 Environmental Control and Waste Treatment

Note: CHEM4023A does not contain any practical component, and has a credit unit value of three (3).

Part II Course Details

1. Abstract

(A 150-word description about the course)

In this course, students will:

- examine the problems of wastewater and solid waste in industrialized and urbanized societies;
- explain various biological wastewater treatment methods, discuss the advantages, disadvantages and problems associated with each of the treatment processes;
- identify the options available for handling solid waste, explain the biological principles and processes involved, discuss the pros and cons of each option;
- critically evaluate present knowledge in treatment of wastewater and solid waste, and provide practical experience in the analysis of waste and wastewater characteristics, treatment processes and efficiency.

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.	Describe and analyze the causes and problems of wastewater and solid waste in industrialized and urban societies, with reference to situation in Hong Kong SAR and our neighbours.	10	✓		
2.	List various wastewater treatment techniques with emphasis on the principles and biochemical reactions in biological processes, critically evaluate the pros and cons of each treatment process, and suggest a recommended approach.	35	✓	✓	✓
3.	Critically evaluate the options for treatment and disposal of municipal and hazardous solid waste including reuse and recycling, explain the biological principles and processes involved, discuss the pros and cons of each option, and advise a preferred option.	30		✓	✓
4.	Design the wastewater/waste treatment processes based on data obtained from laboratory studies and field visits to various treatment facilities in Hong Kong SAR, and communicate results, knowledge and application both orally and in writing.	25	✓	✓	✓
		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	
Group activities	In large and small group activities students will analyze the causes and problems of wastewater and solid waste in industrialized and urban societies, with reference to situation in Hong Kong SAR and our neighbours.	✓	✓	✓	✓	
Group activities, field visits, discussions, debates, and practical classes	Students in large and small group sessions, field visits, discussions, debates, and practical classes to explain the principles and biochemical reactions in various biological treatment processes, compare different treatment processes, and suggest a recommended approach.		✓		✓	
Group activities, field visits, written assignments, debates and presentations	Teaching and learning will be primarily large and small group activities, field visits, written assignments, debates and presentations to evaluate the options for reduce, reuse, recycle, treatment and disposal of municipal and hazardous solid waste, the biological principles and processes involved.			✓	✓	
Practical classes, field visits, discussion and presentations	Through a number of practical classes, field visits, discussion and presentations, students will collect, record, analyze and interpret data on waste and wastewater treatment efficiency, relate results to principles, and critically evaluate the limitations of the design presented.		✓	✓	✓	

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	CHEM4023	CHEM4023A	
Continuous Assessment: <u>40%</u>							
Short Quizzes	✓	✓	✓		5	10	
Tutorial Assignment and Presentation		✓	✓	✓	15	25	
Problem-based Learning					4	5	
Laboratory Performance, Report and Presentation		✓	✓	✓	12	--	(for CHEM4023 only)
Field Visit Reports		✓	✓	✓	4	--	(for CHEM4023 only)
Examination: <u>60%</u> (duration: 3 hours)							
* The weightings should add up to 100%.					100%	100%	

Starting from Semester A, 2015-16, students must satisfy the following minimum passing requirement for courses offered by CHEM:

"A minimum of 40% in both coursework and examination components."

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. Short Quizzes	understanding of the topics and reading materials; correctness of interpretation of data	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Tutorial Assignment and Presentation	understanding of key issues related to the topics and reading materials; ability to explain the concepts and materials; application of knowledge in solving real life problems	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Problem-based Learning	developing insightful / innovative ideas; application of knowledge in solving real life problems	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Laboratory Performance, Report and Presentation	conducting laboratory work; correctness of interpretation and analysis of experimental data; ability to explain and discuss the results	High	Significant	Moderate	Basic	Not even reaching marginal levels
5. Field Visit Reports	attending field visit; raise relevant questions; correctness of interpretation and explanation of the knowledge learned during the visit	High	Significant	Moderate	Basic	Not even reaching marginal levels
6. Examination	completeness and correctness of answers; correctness of interpretation and analysis of experimental data; application of knowledge in solving real life problems; logic of argumentation and intelligent use of course content / original thinking	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.)

Wastewater Treatment Options

Brief description of various options of wastewater treatment, including wetland and agricultural land systems. Reference to the Hong Kong situation.

Biological Aspects of Wastewater Treatment

Principles and efficiency of biological systems in reducing pollutants from wastewater in particular, organic matter, nitrogen, phosphorus compounds, heavy metals and other organic substances. Brief introduction to importance of application of biotechnology in wastewater treatment.

Anaerobic Digestion of Sewage Sludges

Biochemical reactions and microorganisms involved. Environmental requirements. Biogas production and re-uses of digested sludge.

Conventional Waste Disposal Options

Sanitary landfills, composting, incineration, ocean dumping, waste reuse, recycle and minimization. Reference to the situation in Hong Kong. Hazardous waste and its disposal.

Reutilization of Waste as Feed and Food

Bioconversion of waste to single cell and plant protein. Nutritive value and digestability of waste as animal food and feed. Problems of toxic compounds. Public health and public acceptance. Contribution of biotechnology on waste re-utilization.

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.	
2.	
3.	
...	

2.2 Additional Readings

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

1.	EPD (Environmental Protection Department) Environment Hong Kong. Hong Kong Government Printer.
2.	Hong Kong Government (2014) Food waste and yard waste: A plan for Hong Kong 2014-2022. Environment Bureau.
3.	Hong Kong Government (2013) Blue print for sustainable use of resources 2013-2022. Environment Bureau.
4.	Buddolla Viswanath (2017) Environmental Biotechnology: Basic Concepts and Applications. Oxford: Alpha Science International Ltd.
5.	Jain Monika (2014) Environmental Biotechnology. Oxford: Alpha Science International Ltd.
6.	Hopcroft Francis J (2015) Wastewater Treatment Concepts and Practice. New York, NY: Momentum Press.
7.	Das Surajit (2014) Microbial Biodegradation and Bioremediation. London, Waltham, MA: Elsevier.
8.	Rada Elena Cristina (Editor, 2016) Biological Treatment of Solid Waste: Enhancing Sustainability. Toronto: Apple Academic Press.

9.	Prasad M N V (2016) Environmental Materials and Waste: Resource Recovery and Pollution Prevention. London: Academic Press.
10.	Ismail Ahmad Fauzi and Matsuura Takeshie (Editors) (2016) Membrane Technology for Water and Wastewater Treatment, Energy and Environment. Boca Raton: CRC Press.
11.	Mastellone, Maria Laura (2015) Waste Management and Clean Energy Production from Municipal Solid Waste. New York : Nova Publishers.
12.	Hammer M.J. and Hammer M.J.Jr. (2012) Water and Wastewater Treatment Technology (7th edition). Prentice-Hall Inc.
13.	Gabriel B. (2010) Wastewater Microbiology (4th edition). John Wiley, New York.
14.	Tchobanoglous G. et al. (2014). Wastewater Engineering: Treatment and Resource Recovery (5th edition). McGraw-Hill Education, New York.
15.	Relevant websites

A. Please specify the Gateway Education Programme Intended Learning Outcomes (PILOs) that the course is aligned to and relate them to the CILOs stated in Part II, Section 2 of this form:

GE PILO	Please indicate which CILO(s) is/are related to this PILO, if any (can be more than one CILOs in each PILO)
PILO 1: Demonstrate the capacity for self-directed learning	
PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology	
PILO 3: Demonstrate critical thinking skills	
PILO 4: Interpret information and numerical data	
PILO 5: Produce structured, well-organised and fluent text	
PILO 6: Demonstrate effective oral communication skills	
PILO 7: Demonstrate an ability to work effectively in a team	
PILO 8: Recognise important characteristics of their own culture(s) and at least one other culture, and their impact on global issues	
PILO 9: Value ethical and socially responsible actions	
PILO 10: Demonstrate the attitude and/or ability to accomplish discovery and/or innovation	

GE course leaders should cover the mandatory PILOs for the GE area (Area 1: Arts and Humanities; Area 2: Study of Societies, Social and Business Organisations; Area 3: Science and Technology) for which they have classified their course; for quality assurance purposes, they are advised to carefully consider if it is beneficial to claim any coverage of additional PILOs. General advice would be to restrict PILOs to only the essential ones. (Please refer to the curricular mapping of GE programme: http://www.cityu.edu.hk/edge/ge/faculty/curricular_mapping.htm.)

B. Please select an assessment task for collecting evidence of student achievement for quality assurance purposes. Please retain at least one sample of student achievement across a period of three years.

Selected Assessment Task