香港城市大學
City University of Hong Kong

SYL

Course Syllabus

offered by Department of Chemistry
with effect from Semester A 2018/19

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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Part I Course Overview

Course Title:	Advanced Chemical Instrumentation for Research
Course Code:	BCH8008
Course Duration:	1 semester
Credit Units:	3 credits
Level:	R8
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)*	Nil
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)

The course aims to provide the student with concepts and principles of some advanced and widely used research techniques and instrumental methods in chemistry. The course will introduce to the students the basic concepts, working principles and specific capabilities of different chemical instrumentations.

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 and apply the basic concepts and working principles of electronic spectroscopy (UV-VIS absorption and fluorescence) and vibrational spectroscopy (Raman and IR), review the latest developments in laser based time-resolved electronic and vibrational spectroscopies, and evaluate their capabilities for researches.		√	√	
2.	Explain and apply the basic concepts and working principles of mass spectrometry, characterize the capabilities of commonly used ion sources and mass analyzers for chemical analyses, and evaluate their usages for researches.		√	√	
3.	Explain and apply the basic concepts and working principles of *in situ* IR and NMR spectroscopies, and analyze their usages in chemical analyses.		√	√	
4.	Demonstrate critical thinking skills in proposing possible applications of UV-VIS, fluorescence, IR, Raman, NMR spectroscopies, and mass spectrometry for modern chemical researches and justify the selection of the most appropriate instrumental methods or their combination to perform a given research task.		√	√	√
** If weighting is assigned to CILOs, they should add up to 100%.*		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	
Lectures	Basic concepts, working principles, and latest instrumental developments in time-resolved electronic and vibrational spectroscopies with some recent applications will be discussed and reviewed.	✓				
Lectures	Basic concepts, working principles, and the capabilities of commonly used ion sources and mass analyzers in mass spectrometry with some recent applications will be discussed and reviewed.		✓			
Lectures	Basic concepts and working principles of *in situ* IR and NMR with some recent applications will be discussed and reviewed.			✓		
Assignment: literature reviews	Through literature search of latest publications, students will propose possible applications of UV-VIS, fluorescence, IR, Raman, NMR spectroscopies, and mass spectrometry for modern chemical researches.				✓	

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: 30%						
Literature reviews, group discussions and oral presentation	✓	✓	✓	✓	30%	
Examination: 70% (duration: 3 hours)						
** The weightings should add up to 100%.*					100%	

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

"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. Literature reviews, group discussions and oral presentation	Capacity for self-directed learning to understand the principles of advanced chemical instrumentation	High	Significant	Moderate	Basic	Not even reaching marginal levels
	Ability to critically evaluate some selected literature on the usage of advanced instrumentation for modern chemical researches	High	Significant	Moderate	Basic	Not even reaching marginal levels
	Ability to propose with detail explanation possible applications of advanced instrumentation for modern chemical researches	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Examination	Ability to explain in detail and with accuracy the principles of advanced chemical instrumentation and their applications for modern chemical researches	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.)

UV-Vis absorption, fluorescence spectroscopy, Raman spectroscopy, Infrared (IR) spectroscopy, Fourier Transfer IR spectroscopy, time domain and frequency domain spectra, continuous wave laser, pulsed laser, time-resolved spectroscopy with time window ranging from femtosecond to millisecond, time-resolved fluorescence, transient absorption, time-resolved resonance Raman, fluorescence photocounting, laser flash photolysis, mass spectrometry, electron ionization, fast atom bombardment, chemical ionization, electrospray, laser desorption, quadrupole mass analyzer, quadrupole ion trap, time-of-flight, Fourier transform ion cyclotron resonance, hybrid instruments, tandem mass spectrometry, *in situ* IR and NMR.

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.	Principles of Instrumental Analysis; D. A. Skoog, F. J. Holler, S. R. Crouch; (Cengage Learning, 2018, 7th Ed.)
2.	Mass Spectrometry - A Textbook; J. H. Gross; (Springer-Verlag, 2017, 3rd Ed.)
3.	Mass Spectrometry: Principles and Applications; E. de Hoffmann, V. Stroobant; (John Wiley & Sons Ltd., 3rd Ed., Reprinted 2012)

Annex
(for GE courses only)

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