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
Course Code:	BCH6118
Course Duration:	1 semester
Credit Units:	3 credits
Level:	P6
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)

This course enables students of postgraduate level to more in-depth understand concepts and principles of advanced chemical instrumentation (electron, vibration and NMR spectroscopies and mass spectrometry) applied for a wide variety of advanced chemistry disciplines (such as catalysis, synthetic chemistry, materials & biomaterials chemistry, analytical & bio-analytical sciences, computational chemistry, environmental chemistry and chemical biology). Through review and discussion on some recent literature, the latest instrumental developments will be introduced to students, and their advantages, limitations and challenges for chemical research and development will also be critically evaluated. Individual literature review followed by small group discussions will allow students to identify nowadays chemical problems and propose plausible usages of the advanced instrumentation to obtain chemical information to tackle the problems. On completion of this course, students should be able to design experiments with application of most appropriate instrumental tools or their combination to solve problems in chemistry and molecular sciences.

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 fundamental concepts and working principles of advanced instrumentation, such as electron, vibration and nuclear magnetic resonance spectroscopies and mass spectrometry, for chemical analysis.	30%	✓	✓	
2.	Review the latest developments in the above techniques and critical evaluate their advantages, limitations and challenges for research and development in chemistry and molecular sciences, with special emphasis on molecular design and chemical methodology in synthetic and analytical chemistry.	40%	✓	✓	
3.	Propose plausible innovative and practical applications of the above advanced instrumentation for modern chemical research and development. Justify the selection of the most appropriate instrumental method or their combination to solve defined chemical problems.	30%	✓	✓	✓
	** 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	
Lecture / Tutorial	Students will develop an understanding on the fundamental concepts and working principles of the latest developments in electron, vibration and nuclear magnetic resonance spectroscopies and mass spectrometry.	✓			3 hrs/wk for 4 weeks
Lecture / Tutorial	Through review and critical evaluation of chemical information and key findings in some recent chemical literature, students will develop an understanding on the advantages, limitations and challenges of the above advanced instrumentation methods for research and development in chemistry and molecular sciences.		✓		3 hrs/wk for 6 weeks
Literature review / Small group discussion / Individual written report	Through individual literature review followed by small group discussions, students will identify nowadays chemical problems in selected chemistry disciplines (such as catalysis, synthetic chemistry, materials & biomaterials chemistry, analytical & bio-analytical science, computational chemistry, environmental chemistry and chemical biology) and propose plausible usages of the most appropriate instrumental method or their combination to obtain chemical information.	✓	✓	✓	3 hrs/wk for 3 weeks

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		
Continuous Assessment: 30%					
Small group discussions	✓	✓	✓	10%	
Written reports	✓	✓	✓	20%	
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. Small group discussions	ABILITY to acquire and organize chemical information from literature on advanced chemical instrumentation to facilitate effective discussion ABILITY to augment and apply chemical information from literature on advanced chemical instrumentation for solving chemical problems intelligently ABILITY to communicate with peers with accuracy on advanced chemical instrumentation	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Individual written reports	ABILITY to develop an understanding on fundamental concepts and working principles of advanced chemical instrumentation for chemical analysis ABILITY to logically explain and justify the design of instrumental methods to solve problems in chemistry and molecular sciences.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	ABILITY to logically describe and explain fundamental concepts and working principles of advanced chemical instrumentation with accuracy for chemical analysis and integrate the knowledge to critically evaluate the advantages, limitations and challenges of these instrumentation in solving problems in chemistry and molecular sciences.	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.)

Advanced optical spectroscopic techniques and their relationships with electronic and bonding structures, Fourier transform 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, *in situ* IR and NMR, COSY, NOESY, mass spectrometry, time-of-flight, linear quadrupole, quadrupole ion trap, orbitrap, Fourier transform ion cyclotron resonance, hybrid instruments, electron/chemical ionization, fast atom bombardment, electrospray, laser desorption, tandem mass spectrometry, collision activation, IR/UV photodissociation, election-capture/transfer dissociation, ion-mobility spectrometry.

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.	Introduction to Spectroscopy; D. L. Pavia, G. M. Lampman, G. S. Kriz, J. R. Vyvyan; (Cengage Learning 2015, 5th Ed.)
3.	Mass Spectrometry - A Textbook; J. H. Gross; (Springer-Verlag, 2017, 3rd Ed.)
4.	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