City University of Hong Kong
Course Syllabus

offered by Department of Chemistry
with effect from Semester A 2022/23

Part I Course Overview

Course Title:	Solid State Analysis
Course Code:	CHEM8016
Course Duration:	1 semester
Credit Units:	3 credits
Level:	R8
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

This course provides students the principles and applications of some widely used instruments in materials chemistry. The course will focus on the understanding of the working principles, advantages and limitations of different instruments in the characterization of compositions, morphologies and electronic properties of materials.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Evaluate the working principles of advanced instruments in the characterization of composition, morphologies and electronic properties of materials including XPS, SEM, TEM, and XAS.		✓		
2.	Evaluate the advantages and limitations of the instruments in characterization in comparison to the traditional instruments such as elemental combustion and optical microscope.		✓		
3.	Interpret and analyse the data. Extrapolate compositional and structural information from data and correlate with materials performance.		✓	✓	✓
4.	Critically evaluate various characterization techniques and rationally select appropriate instruments for characterizations in research.		✓	✓	✓
		100%			

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)

TLA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
Lectures (Fundamental)	Explain the physical principles and design principles of instrument.	✓	✓			
Lectures (Case Study)	Review data in literatures. Understand the data interpretation and the correlation between structure and performance.	✓	✓	✓	✓	
Presentation and Report	Students will select a new technique for materials characterization, starting from the principles and instrumentation to applications.	✓	✓	✓	✓	

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.				Weighting*	Remarks
	1	2	3	4		
Continuous Assessment: 40%						
Presentations	✓	✓	✓	✓	20%	
Reports	✓	✓	✓	✓	20%	
Examination: 60% (duration: 3 hours)						
Examination	✓	✓	✓	✓	60%	
					100%	

Starting from Semester A, 2015-16, students must satisfy the following minimum passing requirement for CHEM courses:
"A minimum of 40% in both coursework and examination components."

5. Assessment Rubrics

Applicable to students admitted in Semester A 2022/23 and thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Presentations	Demonstration of understanding the principles and practice of the selected characterization technique.	Excellent organization of the content and presentation skills; Excellent explanation of the selected instrument design principle with data.	Good organization of the content and presentation skills; Good explanation of the selected instrument design principle with data.	Basic organization of the content and presentation skills; Basic explanation of the selected instrument design principle with data.	Not even reaching marginal levels
2. Reports	Demonstration of understanding the principles and practice of the selected characterization technique.	Excellent organization of the content and writing skills; Excellent explanation of the selected instrument design principle with data.	Good organization of the content and writing skills; Good explanation of the selected instrument design principle with data.	Basic organization of the content and writing skills; Basic explanation of the selected instrument design principle with data.	Not even reaching marginal levels
3. Examination	Demonstration of understanding the principles and practice of various advanced instruments for materials characterization.	High ability to understand the instrument design principle and analyse the data; High ability to select appropriate instrument for structural characterization	Good ability to understand the instrument design principle and analyse the data; Good ability to select appropriate instrument for structural characterization	Basic ability to understand the instrument design principle and analyse the data; Basic ability to select appropriate instrument for structural characterization	Not even reaching marginal levels

Applicable to students admitted before Semester A 2022/23

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Presentations	Demonstration of understanding the principles and practice of the selected characterization technique.	Excellent organization of the content and presentation skills; Excellent explanation of the selected instrument design principle with data.	Good organization of the content and presentation skills; Good explanation of the selected instrument design principle with data.	Moderate organization of the content and presentation skills; Moderate explanation of the selected instrument design principle with data.	Basic organization of the content and presentation skills; Basic explanation of the selected instrument design principle with data.	Not even reaching marginal levels
2. Reports	Demonstration of understanding the principles and practice of the selected characterization technique.	Excellent organization of the content and writing skills; Excellent explanation of the selected instrument design principle with data.	Good organization of the content and writing skills; Good explanation of the selected instrument design principle with data.	Moderate organization of the content and writing skills; Moderate explanation of the selected instrument design principle with data.	Basic organization of the content and writing skills; Basic explanation of the selected instrument design principle with data.	Not even reaching marginal levels
3. Examination	Demonstration of understanding the principles and practice of various advanced instruments for materials characterization.	High ability to understand the instrument design principle and analyse the data; High ability to select appropriate instrument for structural characterization	Good ability to understand the instrument design principle and analyse the data; Good ability to select appropriate instrument for structural characterization	Moderate ability to understand the instrument design principle and analyse the data; Moderate ability to select appropriate instrument for structural characterization	Basic ability to understand the instrument design principle and analyse the data; Basic ability to select appropriate instrument for structural characterization	Not even reaching marginal levels

Part III Other Information

1. Keyword Syllabus

Materials characterization, elemental composition, surface morphology, electronic structure, X-ray spectroscopy, electron microscope

2. Reading List

2.1 Compulsory Readings

2.2 Additional Readings

L. Reimer, “Scanning Electron Microscope”, 2nd Ed., Springer-Verlag, 1998
D. Koningsberger & R. Prins, “X-ray Absorption Spectroscopy: Principles, Applications and Techniques of EXAFS, SEXAFS and XANES”, Wiley, 1988
John F. Moulder, “Handbook of X-ray Photoelectron Spectroscopy”, Perkin-Elmer Corp. 1992
Frans D. Tichelaar, “Transmission Electron Microscopy as Nanolab”, Wiley, 2012