

**City University of Hong Kong
Course Syllabus**

**offered by Department of Chemistry
with effect from Semester A 2024/25**

Part I Course Overview

Course Title:	Advanced Analytical Biochemistry
Course Code:	CHEM8132
Course Duration:	1 semester
Credit Units:	4 credits
Level:	R8
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: <i>(Course Code and Title)</i>	Nil
Precursors: <i>(Course Code and Title)</i>	CHEM2003/BCH2003 Biochemistry CHEM2004/BCH2004 Principles of Analytical Chemistry
Equivalent Courses: <i>(Course Code and Title)</i>	BCH8132 Advanced Analytical Biochemistry
Exclusive Courses: <i>(Course Code and Title)</i>	Nil

Part II Course Details

1. Abstract

The course aims to study recently developed analytical methods and techniques for analysis of cells, proteins, nucleic acids, and metabolites. Applications of these techniques in biological, biochemical, biomedical, and chemical biological research will be discussed.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs [#]	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes		
			A1	A2	A3
1.	Apply the concepts of modern analytical and instrumental techniques relevant to quantitative measurements in biology, biochemistry, biomedicine, and chemical biology.	30%	✓	✓	
2.	Justify the selection of bio-analytical methods to characterize the composition of a complex, multi-component sample such as genomes, transcriptomes, proteomes, metabolomes, and different cell types.	30%	✓	✓	
3.	Critically evaluate the merits, limitations and future trends, of various bioanalytical techniques, and critically evaluate the most up-to-date research literatures in terms of the applications of bioanalytical techniques.	25%		✓	✓
4.	Apply bioanalytical techniques in a multidisciplinary research and discovery-based approach to postgraduate research projects in the areas of biology, biochemistry, biomedicine, and chemical biology.	15%		✓	✓
		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. Learning and Teaching Activities (LTAs)

LTA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
Lectures and tutorials	Students will learn various principles, applications, and methodologies of analytical biochemistry in lectures and tutorials.	✓				
Lectures and tutorials	Students will learn the selection of bio-analytical methods to characterize the composition of a complex, multi-component sample, such as genomes, proteomes, and different cell types, in lectures and tutorials.		✓			
Case studies, discussions/presentations and literature review	Students will perform case studies, along with student discussions/presentations through individual and/or group work, and a literature review to apply analytical principles to discover underlying molecular information and further understand advances in the biological and biochemical fields and to analyze the merits, limitations and applicability of various analytical biochemistry techniques.			✓		
Case studies	Students will present case studies on their research projects.				✓	

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.				Weighting	Remarks
	1	2	3	4		
Continuous Assessment: <u>40%</u>						
Continuous assessment	✓	✓			10%	
Literature review essay writing			✓	✓	15%	
Oral presentation	✓	✓	✓		15%	
Examination: <u>60%</u> (duration: 3 hours)						
					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

Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Continuous assessment	Ability to solve problems related to analytical biochemistry	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Literature review essay writing	Ability to critically evaluate the merits, limitations and future trends, of various bioanalytical techniques, and critically evaluate the most up-to-date research literatures in terms of the applications of bioanalytical techniques	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Oral presentation	Ability to present a topic related to analytical biochemistry	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Examination	Ability to apply the concepts of modern analytical and instrumental techniques relevant to quantitative measurements in biology, biochemistry, biomedicine, and chemical biology, to justify the selection of bio-analytical methods to characterize the composition of a complex, multi-component sample such as genomes, transcriptomes, proteomes, metabolomes, and different	High	Significant	Moderate	Basic	Not even reaching marginal levels

	cell types					
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Applicable to students admitted from Semester A 2022/23 to Summer Term 2024

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Continuous assessment	Ability to solve problems related to analytical biochemistry	High	Significant	Basic	Not even reaching marginal levels
2. Literature review essay writing	Ability to critically evaluate the merits, limitations and future trends, of various bioanalytical techniques, and critically evaluate the most up-to-date research literatures in terms of the applications of bioanalytical techniques	High	Significant	Basic	Not even reaching marginal levels
3. Oral presentation	Ability to present a topic related to analytical biochemistry	High	Significant	Basic	Not even reaching marginal levels
4. Examination	Ability to apply the concepts of modern analytical and instrumental techniques relevant to quantitative measurements in biology, biochemistry, biomedicine, and chemical biology, to justify the selection of bio-analytical methods to characterize the composition of a complex, multi-component sample such as genomes, transcriptomes, proteomes, metabolomes, and different cell types	High	Significant	Basic	Not even reaching marginal levels

Part III Other Information

1. Keyword Syllabus

Topic 1: Introduction and Review

Cells, its components, and biomolecules;

Bioanalytical techniques: A survey

Topic 2: Cell-based techniques

Flow cytometry, Coulter counter

Cell culture: 2D and 3D

Confocal fluorescence microscope (including GFP and FRET)

Topic 3: Nucleic Acids

Genotyping and forensic DNA techniques

RNA interference

Delivery of DNA and RNA into cultured cells

Topic 4: Proteins

Cloning and expression of recombinant proteins

Production of antibodies and hybridoma technique

Protein identification & separation (including Immunoprecipitation, Western blotting)

Heterogeneous and homogeneous immunoassays

Topic 5: Omics Techniques

Microarray techniques (DNA, protein, tissue)

Functional genomics (including Yeast 2 hybrid)

Proteomics and metabolomics (including MS techniques)

Basic bioinformatics (NCBI Entrez, UCSC genome browser)

Topic 6: Other Frontiers

Analytical chemistry in drug discovery

Analytical chemistry of brains

Nanotechnology & nanomedicine

2. Reading List

2.1 Compulsory Readings

1.	
2.	
3.	
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2.2 Additional Readings

1.	Articles from journals and magazines will be used for selected lectures.
2.	Online Resources: “Nature Biotechnology” It publishes new concepts in technology/methodology of relevance to the biological, biomedical, agricultural and environmental sciences as well as covers the commercial, political, ethical, legal, and societal aspects of this research. http://www.nature.com/nbt/index.html “Biotechniques” The International Journal of Life Science Methods - http://www.biotechniques.com/ “Analytical Chemistry” a journal published by American Chemical Society -

<http://pubs.acs.org/journal/ancham>

“Analyst” a journal published by Royal Society of Chemistry -

<http://pubs.rsc.org/en/journals/journalissues/an>

Articles related to techniques in genomics, proteomics and metabolomics

<http://www.nature.com/omics/subjects/index.html>