

CHEM8132: ADVANCED ANALYTICAL BIOCHEMISTRY

Effective Term

Semester A 2025/26

Part I Course Overview

Course Title

Advanced Analytical Biochemistry

Subject Code

CHEM - Chemistry

Course Number

8132

Academic Unit

Chemistry (CHEM)

College/School

College of Science (SI)

Course Duration

One Semester

Credit Units

4

Level

R8 - Research Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

Nil

Precursors

CHEM2003/BCH2003 Biochemistry, CHEM2004/BCH2004 Principles of Analytical Chemistry

Equivalent Courses

BCH8132 Advanced Analytical Biochemistry

Exclusive Courses

Nil

Part II Course Details

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.

Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1 Apply the concepts of modern analytical and instrumental techniques relevant to quantitative measurements in biology, biochemistry, biomedicine, and chemical biology.	30	x	x	
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	x	x	
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		x	x
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		x	x

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 real-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.

Learning and Teaching Activities (LTAs)

LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1 Lectures and tutorials	Students will learn various principles, applications, and methodologies of analytical biochemistry in lectures and tutorials.	1	

2	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.	2	
3	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.	3	
4	Case studies	Students will present case studies on their research projects.	4	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("- for nil entry)	Allow Use of GenAI?
1	Continuous assessment	1, 2	10	-	Yes
2	Literature review essay writing	3, 4	15	-	Yes
3	Oral presentation	1, 2, 3	15	-	Yes

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

3

Minimum Continuous Assessment Passing Requirement (%)

40

Minimum Examination Passing Requirement (%)

40

Assessment Rubrics (AR)

Assessment Task

Continuous assessment (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to solve problems related to analytical biochemistry

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

Literature review essay writing (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

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

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

Oral presentation (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to present a topic related to analytical biochemistry

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

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

Excellent

(A+, A, A-) High

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Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

Continuous assessment (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Ability to solve problems related to analytical biochemistry

Excellent

(A+, A, A-) High

Good

(B+, B) Significant

Marginal

(B-, C+, C) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

Literature review essay writing (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

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

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Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

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

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Part III Other Information

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

Reading List**Compulsory Readings**

Title	
1	Nil

Additional Readings

Title	
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 -