

CHEM4029: ADVANCED ANALYTICAL CHEMISTRY

Effective Term

Semester A 2025/26

Part I Course Overview

Course Title

Advanced Analytical Chemistry

Subject Code

CHEM - Chemistry

Course Number

4029

Academic Unit

Chemistry (CHEM)

College/School

College of Science (SI)

Course Duration

One Semester

Credit Units

4

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

CHEM2004/BCH2004 Principles of Analytical Chemistry

Precursors

CHEM3027/BCH3027 Analytical Chemistry

Equivalent Courses

BCH4029 Advanced Analytical Chemistry

Exclusive Courses

Nil

Part II Course Details

Abstract

This course aims to give an overview of the rapid developments in various areas of analytical chemistry, in particular, advanced techniques and instrumentation, and to provide training and the understanding of the use of selected, sophisticated instrumental methods.

Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain the basic principles of measurement fundamentals in analytical chemistry and apply such principles to design and validate analytical chemistry experiment procedures.		x	
2	Critically evaluate different contemporary chemical instrumentation and techniques in chemical, biochemical and environmental analysis.		x	
3	Analyze data in the contemporary analytical chemistry literature and effectively communicate this knowledge to peers.	x	x	
4	Design a code of practice for chemists applying advanced analytical chemistry knowledge to demonstrate concern for chemical safety and environmental issues.		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)
Lectures and laboratory experiments	In lectures and laboratory experiments, students will examine various principles, applications and methodologies of selected state-of-the-art instruments.	1	

2	Lectures, group discussions and problem-solving activities	Based on a combination of lectures and large and small group discussions, students will participate in problem-solving activities and gain experience in critically evaluating the literature of analytical chemistry.	2	
3	Case studies and student presentations	Students will learn from case studies and presentations through group work, essay, and oral presentation which will be guided with staff feedback.	3, 4	

Assessment Tasks / Activities (ATs)

ATs	CILO No.	Weighting (%)	Remarks ("- for nil entry)	Allow Use of GenAI?
Literature review and oral presentations	1, 2, 3, 4	15	-	Yes
Lab work	1, 2, 3, 4	20	-	Yes

Continuous Assessment (%)

35

Examination (%)

65

Examination Duration (Hours)

3

Minimum Continuous Assessment Passing Requirement (%)

40

Minimum Examination Passing Requirement (%)

40

Assessment Rubrics (AR)**Assessment Task**

Literature review and oral presentations

Criterion

Ability to pick up a critical topic, give a comprehensive review and present the ideas.

Excellent (A+, A, A-)

Able to demonstrate excellent ability in picking a critical topic, giving a comprehensive review, and presenting the ideas.

Good (B+, B, B-)

Able to demonstrate good ability in picking a critical topic, giving a comprehensive review, and presenting the ideas.

Fair (C+, C, C-)

Able to demonstrate satisfactory ability in picking a critical topic, giving a comprehensive review, and presenting the ideas.

Marginal (D)

Able to demonstrate limited ability in picking a critical topic, giving a comprehensive review, and presenting the ideas.

Failure (F)

Fail to demonstrate ability in picking a critical topic, giving a comprehensive review, and presenting the ideas.

Assessment Task

Lab work

Criterion

Ability to carry out experiments, analyse the data and conclude the results.

Excellent (A+, A, A-)

Able to demonstrate excellent ability in carrying out experiments, analysing the data and concluding the results.

Good (B+, B, B-)

Able to demonstrate good ability in carrying out experiments, analysing the data and concluding the results.

Fair (C+, C, C-)

Able to demonstrate satisfactory ability in carrying out experiments, analysing the data and concluding the results.

Marginal (D)

Able to demonstrate limited ability in carrying out experiments, analysing the data and concluding the results.

Failure (F)

Fail to demonstrate ability in carrying out experiments, analysing the data and concluding the results.

Assessment Task

Examination

Criterion

Ability to give correct answer to the examination questions.

Excellent (A+, A, A-)

Able to demonstrate excellent ability in giving correct answer to the examination questions.

Good (B+, B, B-)

Able to demonstrate good ability in giving correct answer to the examination questions.

Fair (C+, C, C-)

Able to demonstrate satisfactory ability in giving correct answer to the examination questions.

Marginal (D)

Able to demonstrate limited ability in giving correct answer to the examination questions.

Failure (F)

Fail to demonstrate ability in giving correct answer to the examination questions.

Part III Other Information

Keyword Syllabus

Topic 1: Separation Techniques

- Capillary electrophoresis
- Microfluidics techniques

Topic 2: Mass Spectrometry

- LC-MS technique
- MALDI-TOF technique

Topic 3: Bioanalytical Techniques

- Biosensor techniques
- Array techniques

Topic 4: Surface Analysis Techniques

- X-ray photoelectron spectroscopy/Auger electron spectroscopy
- Surface-enhanced Raman spectroscopy

Topic 5: Electron Microscope Techniques

- Scanning electron microscope/Transmission electron microscope
- Scanning tunneling microscope/Atomic force microscope

Topic 6: Current Trend and Future Perspectives of Analytical Chemistry

Reading List

Compulsory Readings

Title	
1	Nil

Additional Readings

Title	
1	Articles from research journals will be provided for each topic.
2	Online Resources: "Analytical Chemistry" a journal published by American Chemical Society - http://pubs.acs.org/journal/ancham
3	Online Resources: "Analyst" a journal published by Royal Society of Chemistry - http://pubs.rsc.org/en/journals/journalissues/an