

CHEM4029: ADVANCED ANALYTICAL CHEMISTRY

Effective Term

Semester A 2022/23

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 DEC-A1 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.

Teaching and Learning Activities (TLAs)

| TLAs | Brief Description | CILO No. | Hours/week (if applicable) |
|------|-------------------------------------|---|----------------------------|
| 1 | Lectures and laboratory experiments | Teaching and learning will be primarily based around lectures and laboratory experiments examining various principles, applications and methodologies of selected state-of-the-art instruments. | 1 |

| | | | | |
|---|--|---|------|--|
| 2 | Lectures, group discussions and problem-solving activities | Teaching and learning will be based on a combination of lectures and large and small group discussions; Problem-solving activities will provide students with experience in critically evaluating the literature of analytical chemistry. | 2 | |
| 3 | Case studies and student presentations | Teaching and learning will be primarily by case studies and student 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 (e.g. Parameter for GenAI use) |
|-----|--|---------------|--|
| 1 | Literature review and oral presentations | 1, 2, 3, 4 | 15 |
| 2 | Lab work | 1, 2, 3, 4 | 20 |

Continuous Assessment (%)

35

Examination (%)

65

Examination Duration (Hours)

3

Additional Information for ATs

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.”

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-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not reaching marginal level

Assessment Task

Lab work

Criterion

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

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not reaching marginal level

Assessment Task

Examination

Criterion

Ability to give correct answer to the examination questions.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not reaching marginal level

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/anchem |
| 3 | Online Resources: "Analyst" a journal published by Royal Society of Chemistry - http://pubs.rsc.org/en/journals/journalissues/an |