

CHEM3027A: ANALYTICAL CHEMISTRY

Effective Term

Semester A 2022/23

Part I Course Overview

Course Title

Analytical Chemistry

Subject Code

CHEM - Chemistry

Course Number

3027A

Academic Unit

Chemistry (CHEM)

College/School

College of Science (SI)

Course Duration

One Semester

Credit Units

3

Level

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

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

Nil

Precursors

Nil

Equivalent Courses

BCH3027A Analytical Chemistry

Exclusive Courses

Nil

Additional Information

Note: CHEM3027A does not contain any practical component, and has a credit unit value of three (3).

Part II Course Details

Abstract

This course aims to enable students to develop an understanding of the principles of analytical chemistry with an emphasis on the common analytical methods and instruments. It builds upon introductory courses in analytical chemistry and extends the scope to include the more in-depth principles of analytical chemistry and the functions of equipment for qualitative and quantitative analysis. In this course, students will have practical experience in analytical, environmental and separation techniques and designing innovative analytical methods, and opportunities of presentation of experimental results. This course offers students knowledge and skills that will allow them to undertake courses in analytical chemistry and instrumental analysis at a more advanced level. Additionally, it prepares graduates with knowledge, discovery capability, and experience in analytical chemistry for industrial applications, laboratory analysis and research studies.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Apply the principles of common analytical techniques including chromatography, atomic spectroscopy, mass spectrometry, potentiometry and fluorescence spectroscopy.	40	x	x	
2	Explain the functions of analytical instruments employed in the above techniques and design innovative analytical methods.	40	x	x	
3	Conduct analysis using analytical instruments and analyse the qualitative and quantitative results.	15		x	
4	Select, design and justify the most appropriate techniques for a range of samples.	5			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 tutorials	In lectures and tutorials, students will develop an understanding on the principles and applications of various analytical techniques including chromatography, atomic spectroscopy, mass spectrometry, potentiometry and fluorescence spectroscopy.	1	1.5
2	Lectures and tutorials	In lectures and tutorials, students will develop an understanding on the functions of common analytical instruments leading to the design of innovative analytical methods.	2	1
3	Practical sessions	Students, in the form of small groups (two to four students each group), will take part in practical sessions in which they will gain experience on using instruments for analysis and develop discovery capability. Students will present, analyse and discuss their experiment results in the form of written reports.	3	2
4	Tutorials	In tutorials, students will discuss and compare common analytical techniques, design and select the most appropriate techniques for different samples from a discovery approach.	4	0.5

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments	1, 2	5	
2	Tests	1, 2	10	
3	Lab Reports	3	15	

Continuous Assessment (%)

30

Examination (%)

70

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**

Assignments

Criterion

ABILITY to develop an understanding on principles of analytical 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

Tests

Criterion

ABILITY to describe and explain basic concepts of analytical chemistry to solve problems

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

Lab Reports

Criterion

ABILITY to conduct analytical chemistry experiments, and present and discuss results in written reports

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

Criterion

ABILITY to describe, explain, and integrate concepts of analytical chemistry and apply them to solve problems

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

Part III Other Information**Keyword Syllabus**Chromatographic Separations

Theory of chromatography.

Gas Chromatography

Principles. Carrier gases, stationary phases and detectors. Applications. GLC and GSC.

High Performance Liquid Chromatography

Principles. Instrumentation. Mobile and stationary phases. Partition, bonded-phase, adsorption, ion-exchange and size-exclusion chromatography. Applications.

Atomic Spectrometry

Principles. Instrumentation. Interferences. Effects of temperature. Applications.

Mass Spectrometry

Principles. Ion sources, mass analysers and transducers. Applications.

Potentiometry

Principles. Reference and indicator electrodes. Glass electrodes. Ion-selective electrodes. Applications.

Fluorescence Spectroscopy

Principles. Instrumentation. Applications.

Reading List**Compulsory Readings**

Title	
1	Nil

Additional Readings

Title	
1	Fundamentals of Analytical Chemistry 9th Edition, Douglas A. Skoog, Donald M. West, F. James Holler and Stanley R. Crouch, Brooks Cole, 2014.
2	Principles of Instrumental Analysis 7th Edition, Douglas A. Skoog, F. James Holler and Stanley R. Crouch, Brooks Cole, 2017.