

CHEM2004: PRINCIPLES OF ANALYTICAL CHEMISTRY

Effective Term

Semester A 2022/23

Part I Course Overview

Course Title

Principles of Analytical Chemistry

Subject Code

CHEM - Chemistry

Course Number

2004

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

Nil

Precursors

Nil

Equivalent Courses

BCH2004 Principles of Analytical Chemistry

Exclusive Courses

Nil

Part II Course Details

Abstract

This course aims to provide students with an understanding of the principles of analytical chemistry, including quantitative analysis based on titrations and instrumental analysis based on modern analytical instruments. It is an introductory course in analytical chemistry. In this course students will develop practical experience in laboratory analysis of the properties and concentrations of chemical molecules, and practice classical and instrumental techniques for the qualitative and quantitative analysis of compounds. The knowledge and skills from this course will prepare graduates for industrial and research applications in analytical chemistry.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the basic principles of analytical chemistry, with emphasis on solution equilibrium and classical methods of analysis, and on selected instrumental analysis methods such as spectroscopy and chromatography, and understand the use of such principles in chemical, biochemical and environmental analysis.	45	x		
2	Select an appropriate instrumental procedure for an analytical or environmental analysis based on spectroscopic and chromatographic methods, and reliably implement it with accuracy and precision.	20	x	x	
3	Design an experimental protocol for analytical or environmental analysis and implement with accuracy and precision.	20		x	x
4	Communicate the chemical measurement and analysis results to relevant professionals in written reports with conclusions based on statistical analysis of the experimental data.	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.

Teaching and Learning Activities (TLAs)

TLAs	Brief Description	CILO No.	Hours/week (if applicable)	
1	Lectures and tutorials	Teaching and learning will be primarily based around lectures and tutorials examining basic principles of classical and instrumental analytical chemistry and their applications in chemical, biochemical and environmental analysis.	1	3
2	Lectures, tutorials and practicals	Teaching and learning will be based on a combination of lectures and tutorials and practicals to explain how to select or design an appropriate instrumental method or procedure and apply data analysis techniques for practical chemical, biochemical and environmental analysis.	2	2
3	Design of an experimental protocol	Based on the knowledge of analytical or environmental analysis on equilibrium calculation and titration methods, students will design an experimental protocol for these measurements.	3	2
4	Practicals	Teaching and learning will be based on practicals to help students to prepare written reports on their practicals with conclusions based on statistical analysis of the experimental data.	4	2

Assessment Tasks / Activities (ATs)

ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)	
1	Tutorial assignments and/or quizzes	1, 2, 3, 4	15	
2	Practicals	1, 2, 3, 4	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

Tutorial assignments

Criterion

Ability to explain in detail of applying principles, concepts and methods to solve chemical, biochemical and environmental problems using instrumental analytical methods

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

Practicals

Criterion

Develop practical experience in laboratory for chemical analysis

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

Capacity for self-directed learning to understand the principle of analytical chemistry and practical applications

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

Data treatment

Gravimetric methods

Aqueous solutions

Equilibrium calculations

Titrimetry/Precipitate formation

Complex-formation/ Complex titrations

Acid-base titrations/ Non-aqueous titrations

Basic electrochemistry

REDOX titrations

Potentiometry

Spectrophotometry

Atomic spectroscopy/ Molecular spectroscopy

Gas chromatography/ Liquid chromatography

Reading List

Compulsory Readings

Title	
1	Nil

Additional Readings

Title	
1	Quantitative Chemical Analysis (Sixth Edition) Author: Daniel C. Harris Publisher: W. H. Freeman and Company
2	Fundamentals of Analytical Chemistry Authors: Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch Publisher: Brooks Cole
3	Online Resources: To be provided, as required, in lectures and tutorials.