

CHEM2004A: PRINCIPLES OF ANALYTICAL CHEMISTRY

Effective Term

Semester A 2024/25

Part I Course Overview

Course Title

Principles of Analytical Chemistry

Subject Code

CHEM - Chemistry

Course Number

2004A

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

BCH2004A Principles of Analytical Chemistry

Exclusive Courses

Nil

Additional Information

Note: CHEM2004A does not contain any practical component, and has a credit unit value of three (3).

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.

Learning and Teaching Activities (LTAs)

LTAs		Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures and tutorials	Students will learn the basic principles of classical and instrumental analytical chemistry and understand their applications in chemical, biochemical and environmental analysis.	1	3
2	Lectures, tutorials and practicals	Students will learn 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	Students will learn the basic analytical or environmental analysis on equilibrium calculation and titration methods, students will design an experimental protocol for these measurements.	3	2
4	Practicals	Students will perform a number of experiments and learn how 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	30	

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

Demonstration of understanding the principles, concepts and methods to solve chemical, biochemical and environmental problems using instrumental analytical strategies

Excellent (A+, A, A-)

Able to demonstrate excellent understanding of the principles, concepts and methods to solve chemical, biochemical and environmental problems using instrumental analytical strategies

Good (B+, B, B-)

Able to describe and explain the principles, concepts and methods to solve chemical, biochemical and environmental problems using instrumental analytical strategies

Fair (C+, C, C-)

Able to describe and explain some key principles, concepts and methods to solve chemical, biochemical and environmental problems using instrumental analytical strategies

Marginal (D)

Able to briefly describe isolated principles, concepts and methods to solve chemical, biochemical and environmental problems using instrumental analytical strategies

Failure (F)

Fail to accurately describe and explain relevant principles, concepts and methods to solve chemical, biochemical and environmental problems using instrumental analytical strategies

Assessment Task

Practicals

Criterion

Demonstration of understanding the principles and practice of chemical analysis

Excellent (A+, A, A-)

Able to demonstrate excellent understanding of the principles and practice of various topics of chemical analysis

Good (B+, B, B-)

Able to describe and explain the principles of various topics of chemical analysis

Fair (C+, C, C-)

Able to describe and explain some key principles of selected topics of chemical analysis

Marginal (D)

Able to briefly describe isolated principles of selected topics of chemical analysis

Failure (F)

Fail to accurately describe and explain relevant principles of any topics of chemical analysis

Assessment Task

Examination

Criterion

Demonstration of understanding the principle of analytical chemistry and practical applications

Excellent (A+, A, A-)

Able to demonstrate excellent understanding of the principles of analytical chemistry and practical applications

Good (B+, B, B-)

Able to describe and explain the principles of analytical chemistry and practical applications

Fair (C+, C, C-)

Able to describe and explain some key principles of analytical chemistry and practical applications

Marginal (D)

Able to briefly describe isolated principles of analytical chemistry and practical applications

Failure (F)

Fail to accurately describe and explain relevant principles of any topics of analytical chemistry

Part III Other Information**Keyword Syllabus**

Data treatment and statistical analysis

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

Principles of chromatography

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.