CHEM2004: 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
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.

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	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

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

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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

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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

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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.