

# CHEM2004: PRINCIPLES OF ANALYTICAL CHEMISTRY

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## Effective Term

Semester A 2025/26

## 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 DEC-A1 DEC-A2 DEC-A3 app.)			
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 ("- " for nil entry)	Allow Use of GenAI?
1	Tutorial assignments and/or quizzes	1, 2, 3, 4	15	-	Yes
2	Practicals	1, 2, 3, 4	15	-	Yes

**Continuous Assessment (%)**

30

**Examination (%)**

70

**Examination Duration (Hours)**

3

**Minimum Continuous Assessment Passing Requirement (%)**

40

**Minimum Examination Passing Requirement (%)**

40

**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

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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

<b>Title</b>	
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.