

# CHEM3027: ANALYTICAL CHEMISTRY

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## Effective Term

Semester A 2024/25

## Part I Course Overview

### Course Title

Analytical Chemistry

### Subject Code

CHEM - Chemistry

### Course Number

3027

### 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

BCH3027 Analytical Chemistry

### Exclusive Courses

Nil

## 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.

### Learning and Teaching Activities (LTAs)

LTAs	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, 4	5	
2	Tests	1, 2, 4	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-)

Demonstrates a excellent level of understanding and application of analytical techniques principles.

#### Good (B+, B, B-)

Shows a significant understanding and application of analytical techniques principles.

#### Fair (C+, C, C-)

Exhibits a moderate understanding and application of analytical techniques principles.

#### Marginal (D)

Displays a basic understanding and application of analytical techniques principles.

#### Failure (F)

Does not reach even marginal levels of understanding and application of analytical techniques principles.

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## Assessment Task

Tests

### Criterion

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

#### Excellent (A+, A, A-)

Demonstrates a excellent level of ability to describe and explain basic concepts of analytical chemistry and solve related problems.

#### Good (B+, B, B-)

Shows a significant ability to describe and explain basic concepts of analytical chemistry and solve related problems.

#### Fair (C+, C, C-)

Exhibits a moderate ability to describe and explain basic concepts of analytical chemistry and solve related problems.

#### Marginal (D)

Displays a basic ability to describe and explain basic concepts of analytical chemistry and solve related problems.

#### Failure (F)

Does not reach even marginal levels of ability to describe and explain basic concepts of analytical chemistry and solve related problems.

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## Assessment Task

Lab Reports

### Criterion

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

#### Excellent (A+, A, A-)

Demonstrates a excellent level of ability to conduct experiments, and present and discuss results comprehensively in written reports

**Good (B+, B, B-)**

Shows a significant ability to conduct experiments, and present and discuss results in written reports

**Fair (C+, C, C-)**

Exhibits a moderate ability to conduct experiments, and present and discuss results in written reports.

**Marginal (D)**

Displays a basic ability to conduct experiments, and present and discuss results in written reports.

**Failure (F)**

Does not reach even marginal levels of ability to conduct experiments, and present and discuss results in written reports.

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**Assessment Task**

Examination

**Criterion**

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

**Excellent (A+, A, A-)**

Demonstrates a excellent level of ability to describe, explain, and integrate concepts of analytical chemistry and apply them effectively to solve problems.

**Good (B+, B, B-)**

Shows a significant ability to describe, explain, and integrate concepts of analytical chemistry and apply them to solve problems.

**Fair (C+, C, C-)**

Exhibits a moderate ability to describe, explain, and integrate concepts of analytical chemistry and apply them to solve problems.

**Marginal (D)**

Displays a basic ability to describe, explain, and integrate concepts of analytical chemistry and apply them to solve problems.

**Failure (F)**

Does not reach even marginal levels of ability to describe, explain, and integrate concepts of analytical chemistry and apply them to solve problems.

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## 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.