

CHEM3015: ORGANIC CHEMISTRY

Effective Term

Semester A 2024/25

Part I Course Overview

Course Title

Organic Chemistry

Subject Code

CHEM - Chemistry

Course Number

3015

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

CHEM2007/BCH2007 Principles of Organic Chemistry

Equivalent Courses

BCH3015 Organic Chemistry

Exclusive Courses

Nil

Part II Course Details

Abstract

This course aims to provide students with an understanding of the principles of carbonyl, aromatic and heterocyclic chemistry and their reaction mechanisms, a practical experience in laboratory in simple and multistep chemical synthesis

and characterization of organic compounds, and analytical skill to identify various classes of organic compounds using IR, UV/Vis and NMR spectroscopies and mass spectrometry.

Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3	
1	Describe the principle of aromaticity.	15	x	x	x
2	Describe the chemistry of carbonyl and aromatic compounds and their use in chemical synthesis.	15	x	x	x
3	Explain the characteristics and mechanisms of various types of reactions related to carbonyl and aromatic compounds with organic reagents and organometallic coupling reactions using e.g. Grignard and organolithium reagents.	20	x	x	x
4	Explain the principles of IR, UV/Vis and NMR spectroscopies and mass spectrometry and apply them to identify various classes of organic compounds.	25	x	x	x
5	Design and implement organic chemical syntheses and characterization in a laboratory and report their findings.(CHEM3015 only)	25	x	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 engage in a combination of interactive lecture and tutorial activities to discuss the structures and bonding of aromatic and carbonyl compounds, explain and apply the reaction mechanisms and the uses of aromatic and carbonyl compounds in synthesis.	1, 2, 3

2	Lectures and tutorials	Students will engage in a combination of interactive lecture and tutorial activities to discuss the principles of spectroscopy, explain and interpret spectral information, identify various classes of organic compounds, and deduce chemical structures of unknown organic compounds.	1, 2, 4	
3	Experiments (CHEM3015 only)	Students will carry out a series of experiments in the laboratory to acquire practical skills in organic syntheses, strengthen their knowledge in characterizing the structures and bonding of aromatic and carbonyl compounds and rationalizing the reaction mechanisms among them, and interpret experimental observations in written reports.	1, 2, 3, 4, 5	

Assessment Tasks / Activities (ATs)

ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Short quizzes	1, 2, 3, 4	Continuous Assessment (30%): - Short quizzes - Tutorial assignments - Laboratory reports
2	Tutorial assignments	1, 2, 3, 4	5
3	Laboratory reports	1, 2, 3, 4, 5	25

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

Short quizzes

Criterion

Ability to use aromatic and carbonyl compounds in synthesis, identify various classes of organic compounds, and deduce chemical structures of unknown organic compounds.

Excellent (A+, A, A-)

High

Able to correctly answer almost all questions

Good (B+, B, B-)

Significant

Able to correctly answer most of the questions

Fair (C+, C, C-)

Moderate

Able to correctly answer some of the questions

Marginal (D)

Basic

Able to correctly answer a few of the questions

Failure (F)

Not even reaching marginal levels

Unable to answer most of the questions

Assessment Task

Tutorial assignments

Criterion

Ability to explain structures and bonding of aromatic and carbonyl compounds, explain and apply their chemical mechanisms for organic syntheses, and explain and interpret spectral information to identify and deduce chemical structures of unknown organic compounds.

Excellent (A+, A, A-)

High

Able to correctly answer almost all questions

Good (B+, B, B-)

Significant

Able to correctly answer most of the questions

Fair (C+, C, C-)

Moderate

Able to correctly answer some of the questions

Marginal (D)

Basic

Able to correctly answer a few of the questions

Failure (F)

Not even reaching marginal levels
Unable to answer most of the questions

Assessment Task

Laboratory reports(CHEM3015 only)

Criterion

Ability to interpret experimental observations, characterize structures and bonding of aromatic and carbonyl compounds, and explain and rationalize their reaction mechanisms presented in written.

Excellent (A+, A, A-)

High
Able to present all required chemical knowledge and concepts precisely and concisely with no errors

Good (B+, B, B-)

Significant
Able to present most of the required chemical knowledge and concepts precisely and concisely with no errors

Fair (C+, C, C-)

Moderate
Able to present some required chemical knowledge and concepts precisely and concisely with only a few errors

Marginal (D)

Basic
Able to present some required chemical knowledge and concepts with some errors

Failure (F)

Not even reaching marginal levels
Unable to present most of the required chemical knowledge and concepts

Assessment Task

Examination

Criterion

Ability to apply knowledge learnt to describe and explain structures and bonding of aromatic and carbonyl compounds; explain, rationalize, and design chemical mechanisms of organic syntheses; interpret spectral information and identify and deduce chemical structures of unknown organic compounds.

Excellent (A+, A, A-)

High
Able to correctly answer almost all the examination questions precisely and concisely with no errors

Good (B+, B, B-)

Significant
Able to correctly answer a substantial number of the examination questions precisely and concisely with no errors

Fair (C+, C, C-)

Moderate
Able to correctly answer most of the examination questions precisely and concisely with only a few errors

Marginal (D)

Basic

Able to correctly answer some of the examination questions with some errors

Failure (F)

Not even reaching marginal levels

Unable to correctly answer most of the examination questions

Part III Other Information**Keyword Syllabus**Aromatic and heterocyclic Chemistry

Introduce, with general examples and applications, aromatic and heterocyclic chemistry. Nomenclature. Physical and chemical properties. Preparations and reactions. Ring synthesis.

Carbonyl Chemistry

Introduce, with general examples and applications, carbonyl chemistry. Nomenclature. Physical and chemical properties. Preparations, reactions and use in synthesis.

Reaction Mechanisms

Nucleophilic and electrophilic aromatic substitution. Carbonyl Addition reactions. The influence of electronic and steric factors on the course of chemical reactions. Organometallic coupling reactions using e.g. Grignard and organolithium reagents.

Application of IR, UV/Vis and NMR spectroscopies and mass spectrometry in organic chemistry

Basic principles and uses of these instrumental techniques, with special reference to various characteristic spectroscopic properties of the various classes of organic compounds.

Reading List**Compulsory Readings**

Title	
1	Nil

Additional Readings

Title	
1	Organic Chemistry / T.W. Graham Solomons, Craig B. Fryhle
2	Introduction To Spectroscopy : A Guide For Students Of Organic Chemistry / Donald L. Pavia, Gary M.Lampman, George S. Kriz, Jr.