

CHEM4086: INDEPENDENT RESEARCH I

Effective Term

Semester A 2024/25

Part I Course Overview

Course Title

Independent Research I

Subject Code

CHEM - Chemistry

Course Number

4086

Academic Unit

Chemistry (CHEM)

College/School

College of Science (SI)

Course Duration

One Semester

Credit Units

8

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

Nil

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

CHEM4036/BCH4036 Project

Part II Course Details

Abstract

Under the supervision of an academic staff member(s) and at a high level of independence, students undertaking this course will:

- develop the ability to synthesize relevant background literature and demonstrate detailed knowledge of the context of their research project, and hypothesize scientific concepts and formulate methods to verify them
- learn to manage a substantial piece of individual laboratory-based research project, and a literature-based investigation
- develop skills in problem-solving and in scientific communication in the form of written and verbal presentation of information

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Develop, state and justify a testable hypothesis related to a practical scientific problem and recognizes the limits of the hypotheses involved, research, assemble, and critically evaluate literature relevant to the hypothesis being tested.		x		
2	Design experiments relevant to the hypothesis being tested, and utilize appropriate laboratory skills and instrumentation(s) to undertake the experiments.			x	
3	Analyze and interpret research data in a critical manner and present experimental results in a clear, concise and accurate scientific format.				x
4	Write a dissertation presenting the hypothesis being tested, a relevant literature review, findings and their interpretation, conclusions, and suggest further lines of investigation organized in the format of a scientific paper.			x	
5	Make a formal oral presentation of the research project, effectively summarizing the project's background, the hypothesis being tested, the methods involved, the results achieved and the conclusions.			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	Discussions	By discussing current literature with the student's supervisor, students will develop and refine a testable hypothesis.	1	
2	Library and web-based searching and literature review	Students will read and interpret relevant scientific literature, and assemble a literature review related to the testable hypothesis.	1	
3	Undertaking of suitable experiments	Students will undertake suitable experiments under supervision, and maintain a log book of data relevant to the experimental process.	2	
4	Data analysis	Students will analyse the data, using appropriate statistical techniques, and present data in summary graphs and tables where appropriate.	3	
5	Update of work progress	Students will update their supervisor on their work progress in the form of an interim written report and oral presentation (10 min + 5 min Q&A)	4, 5	
6	Writing a scientific report	Students will write, under guidance, a formal scientific report summarising the experimental results in the context of knowledge related to the subject matter.	4	
7	Oral presentation	Students will deliver a formal oral presentation of the research project (10 min), followed by questions (5 min) from the audience.	5	

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Discussions and Benchwork	1, 2, 3	25	

2	Interim Update	4, 5	5	
3	Written Dissertation	4	60	
4	Oral Presentation	5	10	

Continuous Assessment (%)

100

Examination (%)

0

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**

1. Discussions and Benchwork

Criterion

Ability to comprehend the background of the project, to set the aims and objectives with the supervisor(s), to design experiments independently and allow control of all variables selected, to appropriately use materials for all procedures without any wastage, to set up apparatuses in the most effective way, to record raw data including units in a way that is clear and appropriate, to be actively, diligently, and independently engaged in the research, and to discuss the findings with the supervisor(s) at regular frequencies.

Excellent (A+, A, A-)

Able to demonstrate excellent knowledge in the research techniques and apply this knowledge in a practical setting

Good (B+, B, B-)

Able to understand the research techniques and apply this knowledge in a practical setting

Fair (C+, C, C-)

Able to understand the key research techniques and apply this knowledge in a practical setting

Marginal (D)

Able to understand some of the research techniques and apply this knowledge in a practical setting

Failure (F)

Fail to understand some of the research techniques and apply this knowledge in a practical setting

Assessment Task

2. Interim Update

Criterion

Ability to provide an update of work progress in the form of a written report and oral presentation, to identify problems and suggest solutions together with backup plans, to present a feasible schedule to complete the project, to suggest alternatives if required.

Excellent (A+, A, A-)

Able to demonstrate excellent knowledge in the research techniques and organize this knowledge in a clear, logical and accurate manner

Good (B+, B, B-)

Able to understand the research techniques and organize this knowledge in a clear, logical and accurate manner

Fair (C+, C, C-)

Able to understand the key research techniques and organize this knowledge in a written manner

Marginal (D)

Able to understand some of the research techniques and organize this knowledge in a written manner

Failure (F)

Fail to understand some of the research techniques and organize this knowledge in a written manner

Assessment Task

3. Written Dissertation

Criterion

Ability to demonstrate thorough understanding of the project topic and excellent execution of a wide range of conventions relevant to science, to logically illustrate mastery of the subject, to use existing references to support the ideas, to present and analyse data in excellent ways, to discuss the assumptions, limitations, and weaknesses, to present logical and excellent explanations for the findings and accurately address the hypothesis, and to use scientific languages that skillfully communicate meaning to readers with clarity and fluency.

Excellent (A+, A, A-)

Able to demonstrate excellent knowledge in the research techniques and organize this knowledge in a clear, logical and accurate manner

Good (B+, B, B-)

Able to understand the research techniques and organize this knowledge in a clear, logical and accurate manner

Fair (C+, C, C-)

Able to understand the key research techniques and organize this knowledge in a written manner

Marginal (D)

Able to understand some of the research techniques and organize this knowledge in a written manner

Failure (F)

Fail to understand some of the research techniques and organize this knowledge in a written manner

Assessment Task

4. Oral Presentation

Criterion

Ability to clearly organize a presentation with cohesive contents, to deliver a compelling presentation with confidence using different techniques (posture, gesture, eye contact, and vocal expressiveness), to understand the questions completely, and to answer the questions as precisely as they can be.

Excellent (A+, A, A-)

Able to deliver fluent, well organized and well prepared presentations to demonstrate excellent understanding of the selected research topic

Good (B+, B, B-)

Able to deliver fluent presentations, with evidence of proper preparation, to describe and explain the selected research topic

Fair (C+, C, C-)

Able to deliver presentations, with evidence of proper preparation, to describe and explain some key principles and findings of the selected research topic.

Marginal (D)

Able to deliver comprehensible presentations to briefly describe isolated principles and findings of the selected research topic.

Failure (F)

Fail to present relevant principles of the selected research topic in coherent and comprehensible manners.

Part III Other Information

Keyword Syllabus

- Management of a substantial piece of individual research and developmental research project at a high level of independence
- Critical thinking and problem-solving skills
- Effective communication in the form of written and verbal presentations of scientific information

Reading List**Compulsory Readings**

Title	
1	Nil

Additional Readings

Title	
1	Online Resources: to be provided as required.