

CHEM3082: GRAPHENE: FUNDAMENTALS AND EMERGENT APPLICATIONS

Effective Term

Semester A 2025/26

Part I Course Overview

Course Title

Graphene: Fundamentals and Emergent Applications

Subject Code

CHEM - Chemistry

Course Number

3082

Academic Unit

Chemistry (CHEM)

College/School

College of Science (SI)

Course Duration

One Semester

Credit Units

3

Level

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

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

Nil

Precursors

PHY1201 (General Physics I), BCH1100 (Chemistry),
CHEM1300 (Principles of General Chemistry),
CHEM2008/BCH2008 (Principle of Physical Chemistry)

Equivalent Courses

BCH3082 Graphene: Fundamentals and Emergent Applications

Exclusive Courses

Nil

Part II Course Details

Abstract

Graphene is the world's first 2-dimensional material and is the thinnest, strongest, and most flexible material known to exist. Graphene, a special form of carbon, can conduct electricity and heat better than anything else. In this course, we will introduce you to the exciting world of graphene science and technology. You will learn about the fundamentals of graphene and how this material offers new insights into nanotechnology and quantum physics. You will also learn about emerging practical applications for graphene. Topics covered include material properties, electronics, physics, physical chemistry, synthesis and characterization techniques and applications.

Graphene offers a wealth of potential future applications; in composites, solar cells, sensors, superchargers, etc. The list is endless. You will be able to decide whether or not graphene can contribute to your own applications, research and future career.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe what is graphene, a 2D-layered material, how is it different from 3 dimensional materials that we encounter everyday	20	x	x	
2	Perform graphene material preparation, characterizations and application orientated properties	30	x	x	
3	Read and explain the scientific articles on graphene research	30		x	x
4	Decide whether or not graphene can contribute to your career advancement	20		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	Student will learn in lecture about graphene, from fundamentals, synthesis, characterizations, and their applications. A "5mins quiz" which recap the content of last lecture will be given at begin of each class to reinforce students' understanding.	1, 2	
2	Experiment demonstration	Students will have a real experience on how to prepare graphene (mechanical exfoliation – in-class, chemical vapour deposition (CVD)-video) and characterize it (AFM, Raman in CHEM' s lab).	1, 2	
3	In-class and online discussions	Students will join some forums/e-courses, related to graphene and then have in-class discussion or in canvas.	1, 2, 3, 4	
4	Group projects (Oral presentations/reports)	Students will present selected topics, scientific papers related to graphene. The topics will be decided through on-/off-line discussions. Students will be asked to write reports after each group presentation and give grade for each presentation.	1, 2, 3, 4	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("- " for nil entry)	Allow Use of GenAI?
1	5 mins quiz/ assignment	1, 2	20	-	Yes
2	Group presentation	1, 2, 3, 4	10	-	Yes
3	Report	1, 2, 3, 4	10	-	Yes

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

40

Minimum Examination Passing Requirement (%)

40

Assessment Rubrics (AR)

Assessment Task

1. 5 mins quiz/ assignment

Criterion

Ability to explain and discuss the fundamentals of graphene, synthesis, characterizations and applications.

Excellent (A+, A, A-)

Able to demonstrate excellent explanation and discussion on the fundamentals of graphene, synthesis, characterizations and applications.

Good (B+, B, B-)

Able to describe and explain the fundamentals of graphene, synthesis, characterizations and applications.

Fair (C+, C, C-)

Able to describe some keys of the fundamentals of graphene, synthesis, characterizations and applications.

Marginal (D)

Able to briefly describe isolated fundamentals of graphene, synthesis, characterizations and applications.

Failure (F)

Fail to describe and explain the relevant fundamentals of graphene, synthesis, characterizations and applications.

Assessment Task

2. Group presentation

Criterion

Ability to enhance the group-works experience, organize a presentation with cohesive content, to understand the topics completely.

Excellent (A+, A, A-)

Able to excellently enhance the group-works experience, organize a presentation with cohesive content, to understand the topics completely.

Good (B+, B, B-)

Able to enhance the group-works experience, organize a presentation with cohesive content, to understand the topics.

Fair (C+, C, C-)

Able to moderately enhance the group-works experience, organize a presentation with cohesive content, to understand the topics.

Marginal (D)

Able to briefly organize a presentation with basic content, to understand the topics

Failure (F)

Fail to organize a presentation with basic content, to understand the topics.

Assessment Task

3. Report

Criterion

1. Ability to communicate scientific information
2. Ability to analyse and evaluate scientific problem/issues.

Excellent (A+, A, A-)

Able to excellently communicate scientific information, analyse and evaluate scientific problem/issues.

Good (B+, B, B-)

Able to communicate scientific information, analyse and evaluate scientific problem/issues.

Fair (C+, C, C-)

Able to moderately analyse and evaluate scientific problem/issues.

Marginal (D)

Able to briefly analyse and evaluate some keys of scientific problems/issues

Failure (F)

Fail to analyse and evaluate any of scientific problems/issues

Assessment Task

4. Final examination

Criterion

Ability to integrate the knowledge in this lecture to their interesting research.

Excellent (A+, A, A-)

Able to excellently integrate the knowledge in this lecture to their interesting research.

Good (B+, B, B-)

Able to integrate the knowledge in this lecture to their interesting research.

Fair (C+, C, C-)

Able to integrate the basic knowledge in this lecture to their interesting research.

Marginal (D)

Able to integrate some keys of the basic knowledge in this lecture to their interesting research.

Failure (F)

Fail to integrate any of the basic knowledge in this lecture to their interesting research.

Part III Other Information

Keyword Syllabus

Introduction to Graphene

Properties of Graphene
Methods for Obtaining Graphene
Characterization Techniques
Applications of Graphene
Graphene, C60 and other carbon related materials
Graphene and You

Reading List

Compulsory Readings

Title	
1	Nil

Additional Readings

Title	
1	Online Resources: To be provided, as required.