

# CHEM3082: GRAPHENE: FUNDAMENTALS AND EMERGENT APPLICATIONS

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## Effective Term

Semester A 2024/25

## 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 (e.g. Parameter for GenAI use)
1	5 mins quiz/ assignment	1, 2	20
2	Group presentation	1, 2, 3, 4	10
3	Report	1, 2, 3, 4	10

**Continuous Assessment (%)**

40

**Examination (%)**

60

**Examination Duration (Hours)**

2

### **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. 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.

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#### **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.

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### 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

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### 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.

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## 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.