School of Environmental and Life Sciences

CHEM2210: Materials Chemistry

Callaghan
Semester 2 - 2023

COURSE OUTLINE

OVERVIEW

Course Description

There are some ninety-two naturally occurring elements in the periodic table. When in combination, these elements form the materials that underpin our everyday lives. This course provides a foundation for understanding the structure, synthesis and chemistry of these materials and nanomaterials. The course includes the descriptive chemistry within four principal classes of materials, integrating key concepts such as symmetry, structure, bonding, synthesis and characterisation. Applications within these classes of materials will also be discussed, such as catalysis, clean energy technologies, and biosensing.

Assumed Knowledge

CHEM1010 Introductory Chemistry I and CHEM1020 Introductory Chemistry II.

Contact Hours

Callaghan
Computer Lab *
Face to Face On Campus
3 hour(s) per Week for 3 Weeks

Laboratory *
Face to Face On Campus
3 hour(s) per Week for 9 Weeks

Lecture
Face to Face On Campus
2 hour(s) per Week for 12 Weeks

Tutorial
Face to Face On Campus
1 hour(s) per Week for 12 Weeks

* This contact type has a compulsory requirement.

Unit Weighting
10

Workload

Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

CONTACTS

Course Coordinator

Callaghan
Prof Alister Page
Alister.Page@newcastle.edu.au
+61 2 4033 9357

Teaching Staff

Other teaching staff will be advised on the course Canvas site.

School Office

School of Environmental and Life Sciences
Room C228 Chemistry Building
Callaghan
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+61 2 4921 5080
9am-5pm (Mon-Fri)

SYLLABUS

Course Content

The course involves study of the structure, synthesis and chemistry of materials including:

- Inorganic Materials, including nanoparticles and semiconductors
- Organic Materials, including surfactants, polymers and self-assembled soft matter
- Carbon Materials, including fullerenes, carbon nanotubes and graphene
- Hybrid/Composite Materials, including coordination complexes and metal-organic frameworks

Course Learning Outcomes

On successful completion of this course, students will be able to:

1. Compare the chemistry, structure and application of inorganic, organic, carbon and composite materials;

2. Describe the synthesis and characterisation of inorganic, organic, carbon and composite materials;

3. Investigate the synthesis, structure, design and reactivity of materials using experimental and computational techniques;

4. Independently integrate key concepts regarding the synthesis, characterisation and chemistry of materials;

5. Apply the scientific method in conducting and reporting experimental investigations;

6. Demonstrate an awareness of the safety responsibilities involved in working with chemicals and hazardous substances.

COMPULSORY REQUIREMENTS

In order to pass this course, each student must complete ALL of the following compulsory requirements:

Contact Hour Requirements:

- Laboratory and Computer Lab - There is a compulsory attendance requirement in this course. Students must attend 90% of the combined wet laboratories and computer laboratories.
- Students who missed a wet laboratory/computer laboratory with a recognised adverse circumstance will have the opportunity to complete that laboratory at a later date.
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- Laboratory Induction Requirement - Students must attend and pass the induction requirements before attending these sessions.

Course Assessment Requirements:

- Assessment 1 - In Term Test: Minimum Grade / Mark Requirement - Students must obtain a specified minimum grade / mark in this assessment item to pass the course. Students must obtain a mark of at least 40% in each test to pass this course.

- Assessment 2 - Tutorial / Laboratory Exercises: Pass Requirement - Students must pass this assessment item to pass the course. Students must submit all reports and obtain an overall mark of at least 50% to pass the course.

- Assessment 2 - Tutorial / Laboratory Exercises: Attempt / Submission Requirement - Students must attempt/submit this assessment item to pass the course.

- Assessment 3 - Report: Pass Requirement - Students must pass this assessment item to pass the course. Students must submit all reports and obtain an overall mark of at least 50% to pass the course.

SCHEDULE

Week	Week Begins	Topic	Learning Activity	Assessment Due
1	17 Jul	Polymer Materials (RC)	Lecture, tutorial, compulsory wet lab (polymers)	Compulsory Lab Induction
2	24 Jul	Polymer Materials (RC)	Lecture, tutorial, compulsory wet lab (polymers)	
3	31 Jul	Polymer Materials (RC)	Lecture, tutorial, compulsory wet lab (polymers)	
4	7 Aug	Hybrid Materials (SC) Coordination chemistry	Lecture, tutorial, compulsory wet lab (MOF synthesis)	RC wet lab report (10%) RC In term test (15%)
5	14 Aug	Hybrid Materials (SC) Metal Organic Frameworks	Lecture, tutorial, compulsory wet lab (structural characterisation of MOF)	
6	21 Aug	Hybrid Materials (SC) Au nanoparticles	Lecture, tutorial, compulsory wet lab (synthesis/analysis of Au nanoparticles)	MOF wet lab report (6%)
7	28 Aug	Introduction to surfactants	Lecture, tutorial, compulsory	Au nanoparticle wet lab report (4%)

		(EW)	wet lab	SC In term test (15%)
8	4 Sep	Surfactants and materials (EW)	Lecture, tutorial, compulsory wet lab	
9	11 Sep	Surfactants and materials (EW)	Lecture, tutorial, compulsory wet lab	
10	18 Sep	Carbon Nanomaterials (AP) Carbon allotropes, low-dimensional materials. Fullerenes	Lecture, tutorial, compulsory computer lab	EW wet lab report (10%) EW In term test (15%)
Mid Term Break				
Mid Term Break				
11	9 Oct	Carbon Nanomaterials (AP) Carbon Nanotubes	Lecture, tutorial, compulsory computer lab	Computer Lab 1 report (3%)
12	16 Oct	Carbon Nanomaterials (AP) Graphene	Lecture, tutorial, compulsory computer lab	Computer Lab 2 report (3%)
13	23 Oct			Computer Lab 3 report (4%) AP In term test (15%)
Examination Period				
Examination Period				

ASSESSMENTS

This course has 3 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	In Term Tests*	Section 1 (coordination materials, nanoparticles): due week 4 Section 2 (polymers): due week 7 Section 3 (surfactants & materials): due week 10 Section 4 (carbon nanomaterials): due week 13	Individual	60%	1, 2, 4
2	Group or Individual Laboratory Exercises and Reports*	Wet Lab Report 1: due at beginning of week 4 lab session Wet Lab Report 2: due at beginning of week 6 lab session Wet Lab Report 3: due at beginning of week 7 lab session Wet Lab Report 4: due at beginning of week 10 lab session	Combination	30%	1, 2, 3, 4, 5, 6
3	Computer Lab Reports*	Computer Lab Report 1: due at beginning of week 11 lab session Computer Lab Report 2: due at beginning of week 12 lab session Computer Lab Report 3: due 1 week after the week 12 lab session	Individual	10%	2, 4, 6

* This assessment has a compulsory requirement.

Late Submissions The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

Assessment 1 - In Term Tests

Assessment Type In Term Test

Purpose In term tests are designed to test the individual student's knowledge of the course material and their ability to describe, analyse and hypothesise from this material.

Description
Section 1 (polymers): 15%
Section 2 (coordination materials, nanoparticles): 15%
Section 3 (surfactants & materials): 15%
Section 4 (carbon nanomaterials): 15%

Weighting 60%

Compulsory Requirements Minimum Grade / Mark Requirement - Students must obtain a specified minimum grade / mark in this assessment item to pass the course.

Length To be discussed in class

Due Date
Section 1 (polymers): due week 4
Section 2 (coordination materials, nanoparticles): due week 7
Section 3 (surfactants & materials): due week 10
Section 4 (carbon nanomaterials): due week 13
See course canvas site for due dates.

Submission Method
In Class
Online
Specific Location
Specific location - Submit to lecturer or in laboratory report boxes

Assessment Criteria The examination is divided into four equal value parts according to the four lecture blocks into

	which the course is arranged. Questions will require short written answers, a limited number of brief calculations, and will ideally be accompanied by relevant diagrams or chemical equations where necessary. Part marks will be awarded according to the level of completeness, understanding and accuracy of a response.
Return Method	In Class Online
Feedback Provided	Returned Work - Returned Work - Two weeks after submission of report. Feedback will be written on marked assessments.
Opportunity to Reattempt	Students WILL be given the opportunity to reattempt this assessment. Students who do not obtain 40% in their first attempt will be given the opportunity to re-attempt the test.

Assessment 2 - Group or Individual Laboratory Exercises and Reports

Assessment Type	Tutorial / Laboratory Exercises
Purpose	Report in the prescribed format describing the activities, outcomes and conclusions from each lab undertaken.
Description	Laboratory work is the central component of chemistry by which knowledge is advanced and the means by which professional chemists contribute to an understanding of real-world problems. Here students will be required to demonstrate sufficient understanding regarding the synthesis and characterisation of various classes of materials and nanomaterials.
Weighting	30%
Compulsory Requirements	Pass Requirement - Students must pass this assessment item to pass the course. Attempt / Submission Requirement - Students must attempt/submit this assessment item to pass the course.
Length	To be discussed in class
Due Date	Wet Lab Report 1: due at beginning of week 4 lab session Wet Lab Report 2: due at beginning of week 6 lab session Wet Lab Report 3: due at beginning of week 7 lab session Wet Lab Report 4: due at beginning of week 10 lab session
Submission Method	In Class Online Specific Location Laboratory report boxes / Canvas submission.
Assessment Criteria	Practical laboratory work and computational simulation are the central components of materials chemistry by which knowledge is advanced and the means by which professional chemists contribute to an understanding of real-world problems. Assessment of practical performance, the quality of results and observational skills, and the ability to explain results together with the related theoretical background should stimulate discussion with demonstrators, lecturers and fellow students.
Return Method	In Class
Feedback Provided	Returned Work - Returned Work - Two weeks after submission of report. Feedback will be written on marked reports.
Opportunity to Reattempt	Students WILL be given the opportunity to reattempt this assessment. Students with valid adverse circumstance will be given the opportunity to re-attempt this assessment.

Assessment 3 - Computer Lab Reports

Assessment Type	Report
Purpose	Report in the prescribed format describing the activities, outcomes and conclusions from each lab undertaken.
Description	Computational chemistry is a key technique for understanding and predicting the structure and properties of materials. Here students will be required to demonstrate sufficient understanding regarding the application of computational chemistry software in the context of carbon nanomaterial synthesis, structure and properties.
Weighting	10%
Compulsory Requirements	Pass Requirement - Students must pass this assessment item to pass the course.
Length	To be discussed in class
Due Date	Computer Lab Report 1: due at beginning of week 11 lab session Computer Lab Report 2: due at beginning of week 12 lab session Computer Lab Report 3: due 1 week after the week 12 lab session

Submission Method	Online Canvas quiz.
Assessment Criteria	Practical computational simulation is a central component of chemistry by which knowledge is advanced and the means by which professional chemists contribute to an understanding of real-world problems. Here students will be required to demonstrate sufficient understanding regarding the synthesis and characterisation of various classes of materials and nanomaterials.
Return Method	Online
Feedback Provided	Online - Two weeks after submission of report. Provided via Canvas.
Opportunity to Reattempt	Students WILL be given the opportunity to reattempt this assessment. Students with valid adverse circumstance will be given the opportunity to re-attempt this assessment.

ADDITIONAL INFORMATION

Grading Scheme

This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.

*Skills are those identified for the purposes of assessment task(s).

Attendance

Attendance/participation will be recorded in the following components:

- Laboratory (Method of recording: Demonstrator notes)

Communication Methods

Communication methods used in this course include:

- Canvas Course Site: Students will receive communications via the posting of content or announcements on the Canvas course site.
- Email: Students will receive communications via their student email account.
- Face to Face: Communication will be provided via face to face meetings or supervision.

Course Evaluation

Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

Oral Interviews (Vivas)

As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the Oral Examination (viva) Procedure.

	In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the Student Conduct Rule.
Academic Misconduct	All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to https://policies.newcastle.edu.au/document/view-current.php?id=35.
Adverse Circumstances	The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where: 1. the assessment item is a major assessment item; or 2. the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system; 3. you are requesting a change of placement; or 4. the course has a compulsory attendance requirement. Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at: https://policies.newcastle.edu.au/document/view-current.php?id=236
Important Policy Information	The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at https://www.newcastle.edu.au/current-students/no-room-for/policies-and-procedures that support a safe and respectful environment at the University.

This course outline was approved by the Head of School. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.