

CHEM3310: Molecular Organic Synthesis

Callaghan

Semester 1 - 2024



THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

OVERVIEW

Course Description The development of modern synthetic materials, whether they be new drugs for the treatment of cancer or for the latest synthetic fabric, requires a knowledge of molecular organic synthesis. Students will develop pre-existing skills (from CHEM2310) to a higher level examining a range of synthetic transformations for functional group transformations, carbon-carbon bond formation and skeletal rearrangements, emphasising the chemo- and stereo-selectivity and mechanism of these reactions. A logical, applied approach backed up by laboratory work will be utilised to emphasise key concepts. Students will also be introduced to the application of molecular organic synthesis to biological systems. Selected literature classics of chemical synthesis will also be included.

Academic Progress Requirements

Nil

Requisites

Pre-requisite - Successful Completion of CHEM2310.

Contact Hours

Callaghan

Laboratory *

Face to Face On Campus

3 hour(s) per week(s) for 13 week(s) starting Week 1

Lecture

Face to Face On Campus

2 hour(s) per week(s) for 13 week(s) starting Week 1

Tutorial

Face to Face On Campus

1 hour(s) per week(s) for 13 week(s) starting Week 1

Unit Weighting Workload

* This contact type has a compulsory requirement.

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

COURSE OUTLINE

CONTACTS

Course Coordinator	Callaghan Dr Thomas Fallon Thomas.Fallon@newcastle.edu.au Consultation: By email or by appointment
Teaching Staff	Dr Robert Chapman Email: Robert.Chapman@newcastle.edu.au Prof Adam McCluskey Email: Adam.McCluskey@newcastle.edu.au Dr Thomas Fallon Email: Thomas.Fallon@newcastle.edu.au
School Office	School of Environmental and Life Sciences Room C228 Chemistry Building Callaghan Science-SELS@newcastle.edu.au +61 2 4921 5080 9am-5pm (Mon-Fri)

SYLLABUS

Course Content	<ol style="list-style-type: none">1. Chemical bonding and skeletal rearrangements<ol style="list-style-type: none">a) Frontier molecular orbital theory. HOMO & LUMOb) Pericyclic reactions. Diels-Alder, 4+2p 2+2pc) Sigmatropic (Claisen) and electrocyclic rearrangementsd) Amine chemistry2. Reactive intermediates and metal mediated transformations<ol style="list-style-type: none">a) Reactive intermediatesb) Pd-catalysed couplings - Heck & Suzuki couplingc) Sonogashira coupling. Metal mediated C-H activationd) Grubbs ring closing and cross metathesis3. Retrosynthesis<ol style="list-style-type: none">a) Synthons, functional group interconversions and protecting group chemistryb) Retro-synthesis of complex molecules of biological importance
Course Learning Outcomes	<p>On successful completion of this course, students will be able to:</p> <ol style="list-style-type: none">1. Identify chemical reactions required for functional group transformations;2. Illustrate mechanisms of organic chemical reactions;3. Design targeted organic synthesis by applying functional group transformations;4. Independently integrate key concepts as applied to chemical reactions, functional group transformations and organic synthesis;5. Use advanced practical lab skills in synthetic tasks and identification of organic compounds;6. Plan, conduct, critically evaluate and report organic synthesis experiments;7. Work safely and competently in an organic chemistry laboratory setting.

COMPULSORY REQUIREMENTS

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

Contact Hour Requirements:

- Laboratory Attend 100% of sessions

Course Assessment Requirements:

- Assessment 1 - Laboratory Reports: Pass requirement - Must pass this assessment item to pass the course.
- Assessment 3 - Final Examination: Pass requirement 40% - Must obtain 40% in this assessment item to pass the course.

SCHEDULE

Week	Week Begins	Topic	Learning Activity	Assessment Due
1	26 Feb	Retrosynthesis (RC)	Lecture (2h) + Tutorial (1h) Lab: Expt 1 (Radical bromination)	
2	4 Mar	Retrosynthesis (RC)	Lecture (2h) + Tutorial (1h) Lab: Induction + 2D NMR workshop	
3	11 Mar	Pericyclic reactions (RC)	Lecture (2h) + Tutorial (1h) Lab: 2D NMR workshop	Lab Report 1 (RC)
4	18 Mar	Pericyclic reactions (RC)	Lecture (2h) + Tutorial (1h) Lab: Expt 2 (Aldol / Diels Alder)	Spectroscopy Assignment (RC)
5	25 Mar	Radicals (AM)	Lecture (2h) + Tutorial (1h) Lab: Expt 2 (Aldol / Diels Alder)	Block Assignment 1 (RC)
6	1 Apr	Easter Monday -- no lectures or laboratory	Tutorial (1h)	Lab Report 2 (AM)
7	8 Apr	Amines (AM)	Lecture (2h) + Tutorial (1h) Lab: Needle training	
Mid-Semester Recess				
Mid-Semester Recess				
8	29 Apr	Carbenes & Nitrenes (AM)	Lecture (2h) + Tutorial (1h) Lab: Expt 3 (Grignard)	
9	6 May	Metathesis (AM)	Lecture (2h) + Tutorial (1h) Lab: Expt 3 (Grignard)	
10	13 May	Metal mediated couplings (TF)	Lecture (2h) + Tutorial (1h) Lab: Expt 3 (Grignard)	Block Assignment 2 (AM)
11	20 May	Metal mediated couplings (TF)	Lecture (2h) + Tutorial (1h) Lab: Expt 4 (Suzuki)	Lab Report 3 (TF)
12	27 May	Stereoselective Synthesis (TF)	Lecture (2h) + Tutorial (1h) Lab: Expt 4 (Suzuki)	
13	3 Jun	Stereoselective Synthesis (TF)	Lecture (2h) Lab: spare session	Lab Report 4 (TF) Block Assignment 3 (poster, TF)
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	Laboratory Reports*	As per laboratory schedule (as detailed in the laboratory manual) or 1 week after completion of the experiment (whichever is later)	Individual	35%	1, 2, 3, 5, 6, 7
2	Written Assignments	Assignment 1: Friday week 5 (29th March, midnight); Assignment 2: Friday week 10 (17th May, midnight); Assignment 3 (poster presentation): Friday week 13 (7th June)	Individual	30%	1, 2, 3
3	Final Examination*	During the exam period, as scheduled	Individual	35%	4

* 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.

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Assessment 1 - Laboratory Reports

Assessment Type

Report

Purpose

Laboratory exercises develop students' appropriate laboratory skills and professional and safety responsibilities. Written lab reports help students develop their skills in acquisition and interpretation of data and production of articulate and concise documents which convey evidence-based understanding of the concepts and topics.

Description

Details of the experiments and guidelines for report writing are given in the Lab Manual. Students are expected to record and present data and write reports in a format suitable for organic chemistry. The first report for the spectroscopy workshop is in the form of a structure elucidation assignment.

Weighting

35%

Compulsory Requirements

Pass requirement - Must pass this assessment item to pass the course.

Length

~1h / week

Due Date

As per laboratory schedule (as detailed in the laboratory manual) or 1 week after completion of the experiment (whichever is later)

Submission Method

Assignment Boxes

Assessment Criteria

Grading rubric for each laboratory report is provided in the laboratory manual. Mark allocation for the spectroscopy assignment will be provided with the questions.

Return Method

In Class

Feedback Provided

In Class - In Class - Within 2 weeks of submission during the laboratory class. Annotated laboratory reports and face-to-face discussion

Opportunity to Reattempt

Students WILL be given the opportunity to reattempt this assessment.

Assessment 2 - Written Assignments

Assessment Type	Written Assignment
Purpose	The progressive in-term assessment is designed to aid understanding of key lecture topics and show evidence of self-directed learning (literature research) and problem-solving skills. These section assessments will support students for final exam revision.
Description	Individual assignments for each of the 3 teaching blocks.
Weighting	30%
Length	~1h / week
Due Date	Assignment 1: Friday week 5 (29th March, midnight); Assignment 2: Friday week 10 (17th May, midnight); Assignment 3 (poster presentation): Friday week 13 (7th June)
Submission Method	Online Specific Location Assignments 1-2 and a draft of assignment 3 will be submitted through the canvas portal. The poster for assignment 3 will be presented at the Discipline of Chemistry research day (Friday morning, week 13).
Assessment Criteria	A grading rubric will be supplied with each assignment task when the task is made available to students.
Return Method	Online
Feedback Provided	Online - Within 2 weeks of submission or on the day in person (for assignment 3 poster).

Assessment 3 - Final Examination

Assessment Type	Formal Examination
Purpose	Designed to demonstrate individual student's knowledge of the course material and their ability to describe, analyse and hypothesise from this material.
Description	This exam will include all lecture material covered from Weeks 1-13.
Weighting	35%
Compulsory Requirements	Pass requirement 40% - Must obtain 40% in this assessment item to pass the course.
Length	2 hours
Due Date	During the exam period, as scheduled
Submission Method	Formal Exam The exam may be online or face to face depending on restrictions at the time.
Assessment Criteria	According to the examination paper.
Return Method	Not Returned
Feedback Provided	No Feedback
Opportunity to Reattempt	Students WILL be given the opportunity to reattempt 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: Attendance/participation will be recorded in the following components: Hard copy sign in sheet).

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/respect-at-uni/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.

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