Chemistry Department

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

General Course Information

CHEM242/BCHM206
Organic Chemistry

0.1250 EFTS 15 Points
Second Semester 2021

Description

The topics covered by this course are:

- π-Bonding Chemistry
- Chemoselectivity, Controlling Reactions and Nitrogen Functional Groups
- Carbonyl Chemistry II - Enols and Enolates as Nucleophiles
- Chemistry of cyclic molecules

This course runs in semester two. It counts 15 points towards a Bachelor of Science degree, and it is preferable that it is taken in conjunction with other 200-level chemistry courses.

Over the last 100 years organic chemistry has given rise to many of the beneficial features of modern daily living that we take for granted. The products of organic chemistry include medicines, dyes, and plastics. Organic chemistry also provides tools to study and understand complex systems including biological processes that are essential to life. Furthermore synthesis allows Chemists to build new molecules for a wide variety of biological and other proposes. For example, how can we design and synthesise new medicines to treat and understand disease?

CHEM242/BCHM206 expands and develops the concepts of organic chemistry taught in the first-year chemistry courses and CHEM212/BCHM212. Organic chemistry provides the critical link between the molecular sciences and biology.

The course provides a balanced treatment of organic chemistry for those who are majoring in chemistry, biochemistry or medicinal chemistry. The depth of treatment will allow students to continue their studies in either, or both, organic chemistry and biochemistry to a higher level.

Timetable

Sessions: Four lectures/workshops/tutorials per week; details to be confirmed on 'My Timetable' and the Web. There will be approximately 1 tutorial for every 3 lectures.

Course Lecturers

Dr Chris Fitchett (24 sessions) ph 369 5344 Beatrice Tinsley 424
e-mail: *chris.fitchett@canterbury.ac.nz*

Prof. Antony Fairbanks (24 sessions) ph 364 3097 Beatrice Tinsley 324
Email: *antony.fairbanks@canterbury.ac.nz*

Tutorials: Tutorials will be taken by the course lecturers with specific times and details provided by each lecturer. Attendance at the tutorials is strongly encouraged and attendance may be taken.

Students should note that in the Science Faculty that the average student is responsible for approximately **3.2 hours of additional study** for each hour of lecture at the 200-level.

Course Co-ordinator

Dr Chris Fitchett, Department of Chemistry
Beatrice Tinsley 424, ext 95344, Email: *chris.fitchett@canterbury.ac.nz*
Email me if you have any queries about the course.

Assessment

- Final Examination: 60%
- Mid-term tests: 40%

Examination and Formal Tests

Tests: Monday 16th of August 19:00 – 20:30 (90 Minutes) in C2.
Monday 11th of October 18:30 – 20:00 (90 Minutes) in C2.
Note: The time and location of each test may change, please check MyTimetable fo any changes.
Exam: Details to be advised.

Textbooks

The textbook for the course is:

Clayden, Greeves, Warren and Wothers, *Organic Chemistry 2nd Edition*, OUP, 2012.

This textbook will be available in the Engineering & Physical Sciences Library, where copies will be on reserve.

Prerequisites

CHEM212 **or** BCHM 212

Learning Outcomes

Mastery of the topics listed below as demonstrated by your performance in the various assessment components.

Goal of the Course

The objectives of the course are to understand:

- the reactivity of chemical and biochemical systems,
- the driving forces associated with chemical and biochemical reactions,
- the process of writing chemical and biochemical reaction mechanisms, and
- the role of synthetic chemistry in chemistry and biochemistry

Summary of the Course Content

The topics coved by this course are:

Dr Chris Fitchett
Beatrice Tinsley 424, ext 95344, *chris.fitchett@canterbury.ac.nz*

The Chemistry of the π-Bond: **(12 Sessions)**

The π-bonds that occur in alkenes, alkynes and aromatic molecules represents the simplest functional group in organic chemistry. They are found in many biologically active compounds, and form the basis for modern organic electronics. In this section of the course we will examine the structure, formation and reactions of simple alkenes and alkynes, including conjugated and aromatic systems.

Chemoselectivity, controlling reactions and nitrogen functional groups: **(12 Sessions)**

Why do the reactions of molecules give the products that they do, and how can we control them? The focus of this section of the course is the importance of selectivity of chemical reactions in chemical synthesis and biochemistry. We will explore how we can predict and understand the outcomes of reactions, with particular emphasis placed on the chemoselectivity of oxidation and reduction in the interconversion of functional groups. We will also investigate how we can control the outcome of reactions using protecting groups, with particular emphasis on chemical peptide synthesis. We will also explore the rich chemistry of nitrogen functional groups.

Prof. Antony Fairbanks
Beatrice Tinsley 424, ext 95217, *antony.fairbanks@canterbury.ac.nz*

Carbonyl Chemistry II: **(12 Sessions)**

A thorough grasp of the chemistry of the carbonyl group is essential to an understanding of organic chemistry. This part of the course will further develop your understanding of the basic reactivity of carbonyl containing compounds that you began in CHEM212/BCHM212 by considering enolization. We will look at the mechanisms of enolization processes, and the reactions of enols and enolates as nucleophiles, particularly to make C-C bonds. Central to synthetic applications of enols/enolates are the Aldol and Claisen condensation reactions, both of which will be covered in detail. The synthetic utility of enolates will then be explored by exemplification using a wide variety of processes, including intramolecular reactions. We

will also consider the reactions of α/β unsaturated carbonyl compounds with nucleophiles and cascade reactions (e.g. the Robinson Ring Annelation). Finally we will also look at key aspects of control of enolate alkylation, e.g. how to achieve C vs O alkylation; how to control the regiochemistry of enolate formation; how to control reactions between two different carbonyl compounds.

Ring Chemistry: **(12 Sessions)**

This part of the course will focus on the structure and special reactivity of cyclic compounds: this study is often termed 'Alicyclic Chemistry'. Topics covered will include the types of strain in cyclic molecules and their conformations. We will look at the synthesis of cyclic molecules, including considerations of both the kinetics and thermodynamics of ring closing reactions. The special reactivity of small and large rings will be rationalised by consideration of their strain energies. The stereochemistry of reactions of six membered rings will be covered in detail, including the different rates of reactions for axial or equatorial substituents. The course will conclude with an introduction to the structures of carbohydrates – which all exist as cyclic molecules.

GENERAL INFORMATION 2021

Chemistry Department Policy on 'Dishonest Practice'

The University has strict guidelines regarding 'dishonest practice' and 'breach of instructions' in relation to the completion and submission of examinable material. In cases where dishonest practice is involved in tests or other work submitted for credit a department may choose to not mark such work ('Academic Integrity and Breach of Instruction Regulations').

The Department of Chemistry upholds this policy. It considers plagiarism, collusion, copying, and ghost writing to be unacceptable and dishonest practices:

- ***Plagiarism*** is the presentation of any material (text, data or figures, on any medium including computer files) from any other source without clear and adequate acknowledgement of the source.
- ***Collusion*** is the presentation of work performed in whole, or in part, in conjunction with another person or persons, but submitted as if it has been completed by the named author alone. This interpretation is not intended to discourage students from having discussions about how to approach an assigned task and incorporating general ideas that come from those discussions into their own individual submissions, but acknowledgement is necessary.
- ***Copying*** is the use of material (in any medium, including computer files) produced by another person or persons with or without their knowledge and approval. **This includes copying of the lab reports (raw data may be shared within the group if permitted or required by the experiment) - data analysis and interpretation of obtained results MUST be performed individually.**
- ***Ghost writing*** is the use of other person(s) (with, or without payment) to prepare all or part of an item of work submitted for assessment.

Additional Information

Special consideration of assessment*:** If you feel that illness, injury, bereavement or any other critical extenuating circumstance beyond your control has prevented you from completing an item of assessment or affected your performance in that assessment, you may apply for special consideration. Special consideration is not available for items worth less than 10% of the course. Applications for special consideration should be made **within five days** of the due date for the work or examination. In the case of illness or injury, medical consultation should normally have taken place shortly before, or within 24 hours after, the due date for the required work or the date of the test or examination. For details on special consideration, or to make an application, refer to the Examinations Office website http://www.canterbury.ac.nz/exams/. ***You have the right to appeal any decision.

Extensions of deadlines: Where an extension may be granted for an assessment item, this will be decided by application to the course co-ordinator.

Late withdrawal from the course: If you are prevented by extenuating circumstances from completing the course after the final date for withdrawing from the course, you may apply for special consideration for late discontinuation. For details on special consideration, or to make an application, refer to the Examinations Office website http://www.canterbury.ac.nz/exams/. Applications must be submitted ***within five days*** of the end of the main examination period for the semester.

Missing of tests**:** In rare cases a student will not be able to sit a test. In such cases, the student should consult with the course co-ordinator to arrange alternative procedures. **This must be done well in advance of the set date for the test.**

Past tests and exams: these can be found on our website using the link below:
www.chem.canterbury.ac.nz/for/undergraduate.shtml

Submission of reports and assignments**: Reports (including lab reports) and assignments should be handed in on time.** Extensions will be granted only in exceptional circumstances (such as illness or bereavement). If an extension is required, as early as possible you should request it from the lecturer concerned.
Note: If you do not submit an assignment for assessment, you will be allotted zero marks, which will affect your final result. You should ensure that you pick up marked assignments and keep them until the end of the course as evidence that the work was completed and marked in the case that either is disputed. To guard against accidental loss, it would be prudent to keep photocopies or electronic copies of anything submitted.

Late Work: Late work should be accompanied by a detailed explanation of why the work is late. The work will be marked, and up to 10% of the total marks will be subtracted for *each day* the work is late, at the discretion of the lecturer. Days late include weekends and holidays. If you know in advance that you will be unable to complete an assessment on time, please contact your lecturer, in advance, to discuss.

Marks and Grades: The following numbers should be considered as a guide to the expected grades under normal circumstances. The School reserves the right to adjust mark/grade conversions, if necessary.

Please note that for all invigilated assessments (tests and exams) worth 33% and above, failure to obtain a mark of at least 40% will result in a final grade no higher than an R at 100 and 200 level, and a C- at 300 level.

Grade:	**A+**	**A**	**A−**	**B+**	**B**	**B−**	**C+**	**C**	**C-**	**D**	**E**
Minimum mark %:	**90**	**85**	**80**	**75**	**70**	**65**	**60**	**55**	**50**	**40**	**0**

Reconsideration of Grades: Students should, in the first instance, speak to the course co-ordinator about their marks. If they cannot reach an agreeable solution, or have questions about their grade in a course, students should then speak to the Director of Undergraduate Studies, Professor Alison Downard (Room 426, Beatrice Tinsley Building, phone 3694228). Students can appeal any decision made on their final grade. You can apply at the Registry for reconsideration of the final grade within four weeks of the date of publication of final results. Be aware that there are time limits for each step of the appeals process.

Students with Disabilities: Students with disabilities should speak with someone at Equity and Disability Service, phone: 369 3334 (or ext. 93334), email: eds@canterbury.ac.nz).

Academic Advice**:** Professor Alison Downard is the coordinator of undergraduate chemistry courses. Her interest is in the academic performance and well-being of all such students. Anyone experiencing problems with their chemistry courses or requiring guidance about their B.Sc. in Chemistry should get in contact with Alison.

Staff-Class Rep Liaison**:** Professor Alison Downard is in charge of liaison with students in chemistry courses. Your class will appoint a student representative to the liaison committee at the start of the semester. Please feel free to talk to the Academic Liaison or the student rep about any problems or concerns that you might have.

Alison Downard
Director of Undergraduate Studies
School of Physical and Chemical Sciences
2021