DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus
Department of Chemistry
Introductory Organic Chemistry II
CHEM2402
Winter Term 2021
Online Format

Instructor(s): **Professor Frances Cozens**, Virtual Office (CHEM2400@dal.ca). Principal Instructor for the 2402 online class 2021.
Office Hours Via Teams – by appointment. You are welcome to e-mail Dr. Cozens if you would like to make an appointment for a specific time.

Dr. Travis Lundrigan, Virtual Office (CHEM2400@dal.ca). CHEM2402 synchronous lecture help sessions, tutorial and student lecture support.
Office Hours Via Teams – by appointment. You are welcome to e-mail Dr. Lundrigan if you would like to make an appointment for a specific time.

Ms. Gaia Aish Virtual Office (ochemlab@dal.ca). Laboratory Instructor, day-to-day supervision for the CHEM2402 laboratories and drop in lecture and lab help. *Office Hours Via Teams – by appointment*.

Dr. Reinaldo Moya-Barrios Virtual Office (ochemlab@dal.ca). Laboratory Instructor, lab help.
Office Hours Via Teams – by appointment.

Lectures: Weekly lecture material will be uploaded to Brightspace in an asynchronous format. The class will be formatted with weekly uploads to Brightspace. The weekly asynchronous material will be uploaded usually on the Tuesday of each week. The material may include, lecture PowerPoint notes, lecture videos of the PowerPoint notes, practice problems and synthetic design tutorials.

Lectures and tutorials: Synchronous Teams weekly meetings will be scheduled throughout the term for synchronous tutorial help in addition to drop-in sessions. Synchronous activities are optional.

Laboratories: Five laboratory modules will be uploaded to Brightspace throughout the term in an asynchronous format. Synchronous Teams meetings will be scheduled as drop-in sessions. Synchronous activities are optional.

The following pages constitute the syllabus for this course, CHEM2402. You can consider the syllabus to be a contract, which delineates responsibilities and expectations for both the students and the teaching team. You should review the syllabus at your earliest convenience, refer to it as necessary throughout the term, and contact the Principal Instructor with any questions and/or concerns you may have.

Course Description Credit hours: 3 Format: Lecture and Lab components
CHEM2402 builds strongly on the information obtained in CHEM2401 and focuses on the properties and reactions of alkenes, alkynes, alcohols, ethers, amines, nitriles, imines, enamines, carbonyl-containing functional groups and aromatic compounds, along with spectroscopy in the laboratory. The reactions learned are also used in synthetic sequences. Detailed and complete reaction mechanisms are investigated. Multi-step synthetic sequences are developed and are an integral part of the course. Organic reactions, organic reaction mechanisms and organic multi-step reactions are the main features of CHEM2402. The concepts of resonance and aromaticity are investigated. NMR spectroscopy is utilized in the laboratories for compound identification.

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Course Prerequisites

PREREQUISITES: CHEM2401.03 (**grade of C+ or better**). CHEM2401 is the prerequisite for CHEM2402. Students who have not obtained a grade of C+ or better, or an equivalent class from another institution, cannot take CHEM2402 unless permission is granted. This requirement is to ensure students have sufficient understanding of the concepts taught in CHEM2401 to be successful in CHEM2402. As such, it is assumed that students have a reasonable grasp of the material in CHEM2401 and have a good understanding of the specific reactions covered, as these concepts are the foundation for CHEM2402. Please note: *material including but not limited to the reactions from CHEM2401 is required to be successful in CHEM2402 and may be present on any quiz, assignment or the final examination in CHEM2402. This also includes stereochemistry.* Students need to fully grasp the concepts and reactions in CHEM2401 before entering CHEM2402.

Course Objectives/Learning Outcomes

Students completing this course, will be able to:

- understand the procedure followed for working in the organic chemistry laboratory to carry out synthetic reactions. This includes virtual set-up and work-up of reactions, recrystallization, thin-layer chromatography, filtration, extraction, reflux and distillation techniques
- interpret fundamental laboratory results related to organic chemistry
- use IUPAC rules to draw and name organic compounds
- draw and interpret proper Lewis structures, including comprehension of contributing resonance structures
- use reactions from CHEM2401 in the development of synthetic schemes
- use curved/curly arrows to depict reactions
- use mechanisms to propose reaction coordinate diagrams
- write out curved arrow-pushing mechanisms for the reactions presented
- understand reactions of alkenes and alkynes and use them in synthetic schemes
- understand reactions of alcohols, ethers and epoxides and use them in synthetic schemes
- understand reactions of carboxylic acids and their derivatives and use them in synthetic schemes
- understand reactions of aldehydes and ketones and use them in synthetic schemes
- understand reactions of imines and enamines and use them in synthetic schemes
- understand reactions of benzene and other aromatics and use them in synthetic schemes
- understand the difference between a kinetic and thermodynamic controlled reaction
- use arrow pushing mechanisms for a wide variety of reactions
- predict and justify reactivity of organic compounds under a variety of experimental conditions
- use reaction coordinate diagrams to show the progress of a reaction
- propose reaction sequences and conditions for the preparation of simple organic compounds
- interpret spectra; propose reasonable structures via ^{1}H and ^{13}C NMR spectra
- apply experimental techniques in a variety of virtual lab situations
- interpret experimental results and write scientific passages

Key knowledge or skills expected of students coming into the course

All aspects of the material contained in CHEM2401, CHEM1011 and CHEM1012 (or equivalents).

Required Course Materials

Lectures: Class material will be available from Brightspace in weekly uploads. NOTE: Lectures notes are subject to change. The most up-to-date set of lecture notes will be available on Brightspace.

Textbook: The official textbook is: "Organic Chemistry" **8th Edition**, by Paula Y. Bruice. This book is available at the University Bookstore as an ebook. In CHEM2402, "Organic Chemistry" by Bruice will be followed closely and lecture notes will be based on the material from this book. The material that will be on the midterm tests and the final examination will be covered in the PowerPoint slides that will be available on Brightspace.

Other textbooks are sometimes helpful as different books explain certain concepts better than others, but assigned material for this course will be defined in terms of the official textbook.

Brightspace: All class material including, class communication via announcements, lecture notes and videos, practice problems and virtual labs, will be posted to Brightspace https://dal.brightspace.com

Teams: Dalhousie-supported Microsoft product for synchronous lecture tutorials and drop-in sessions, virtual lab

drop-in sessions and help along with class appointments: accessible via the "waffle" on MyDal, login via your Dalhousie email address
LON-CAPA: Potentially for the final exam (to be determined): http://capa.conceptsinchemistry.ca

Evaluations: Quizzes will be available for each lecture topic and scheduled during the term. There will be six (6) lecture quizzes. In addition to the online quizzes the class will have one hand-written assignment and a three-hour synchronous final examination. There will also be five (5) laboratory reports to complete during the term.

All work must be completed in the class. If you are experiencing illness, please submit a student declaration of absence and the due date will be adjusted accordingly.
The three-hour final examination will cover the entire course and will be delivered in a synchronous format. A student may write a make-up final examination if the final examination was missed with a justifiable reason. The date and time of the make-up examination will be decided a few days after the CHEM2402 final examination has been written and will be at the end of the regular examination period. The University policy is that final examinations are not returned to students. All material in CHEM2402 is strictly copyright and not for distribution, this includes all components of the class including the final examination.

Independent work. All graded work in CHEM2402 (class and laboratory material) must be done independently by each student enrolled in the class. Online resources can be used for all graded work, except 'cheating' websites such as CHEGG.COM.

Copyright @. All material posted online for CHEM2402 is strictly copyrighted. No class material can be distributed in any way to a third party. Upon investigation via University protocols if a student is found to have participated in the **uploading of any material to a third party such as CHEGG.COM** or sharing with anyone not enrolled in the class this will lead to a **mark of 'F' for CHEM2402**. Please do not upload any portion of CHEM2402 to CHEGG.COM or any other online class distribution website.

All work must be the student's independent and individually prepared work. Student work that is not independently done will receive a **mark of 0 on the submitted material**. Utilizing online resources is allowed.

How to do well in CHEM2402
There is no doubt that CHEM2402 includes a lot of material and is a significant step-up from CHEM2401. All of the information necessary to be successful in CHEM2402 will be uploaded to Brightspace. CHEM2402 is a course that requires discipline and considerable studying to do well. Studying and keeping up with the material is key for a successful outcome. It is recommended that the practice problems are thoroughly worked through prior to viewing the answers.

Here are some additional tips for success:
Review ALL lecture material posted to Brightspace. There is a clear and direct correlation between skipped lectures and poor results in this course. This cannot be stressed enough!
Take your own notes. Taking your own notes from the asynchronous and synchronous material presented will help you to learn. Even though class notes and lectures are provided the more you write your own notes the better you will do.
Study. Keep up with the material. It is critical to stay up with the material. The material in CHEM2402 cannot be learned the day before the final examination.
Practice. Complete the online quizzes in a dedicated manner. Do the practice problem before attempting the topic quiz to help you learn the topic material. Attend the scheduled lecture tutorials!

Lecture Synchronous tutorials and lecture help sessions will be given by Dr. Travis Lundrigan via the Teams platform. Lecture help will start on Monday, January 11, 2021. Additional drop-in question and answer sessions will be added throughout the term.
M: 13.35-14.35
T: 10.05-11.05
T: 14.05-15.05
W: 13.35-14.35
R: 14.05-15.05

Laboratory

Laboratory work is an integral part of this class. The virtual lab work will help you to learn and appreciate practical techniques and will help you to understand lecture topics. The detailed running of the laboratories will be handled by Ms. Gaia Aish and Dr. Reinaldo Moya Barrios and they will be assisted by Teaching Assistants (TAs) (ochemlab@dal.ca). Virtual lab material will begin on Tuesday January 19th, 2021: the lab material will be available on Brightspace. Please note that the first 1 hour of the lab time slot is lecture tutorial and drop-in with Dr. Travis Lundrigan. The second hour will be lab help sessions with a TA. All synchronous sessions are optional in CHEM2402. Laboratory help with your Chemistry TA will start the week of January 19, 2021.
M: 14.35-15.35
T: 11.05-12.05
T: 15.05-16.05
W: 14.35-15.35
R: 15.05-16.05

Laboratory experiments and reports will closely relate to the lecture material during the online Winter 2021 term. Students granted lab exemptions are invited and encouraged to participate in the virtual lab exercises since the new virtual lab material is examinable on the topic quizzes, assignment and the final exam. Lab exempt students who choose to take the virtual lab in Winter 2021 will receive whichever lab grade is highest at the end of term (2020 or the previous academic year).
• All laboratory activities will be online.
• All work must be independent.
• Presentation of the lab material will be asynchronous.
• Each week there will synchronous lab drop-in where you can meet with your TA and discuss the material being presented in the lab modules, lab report questions and questions related to data analysis in general.
• All the necessary laboratory information will be available in the CHEM2402 Brightspace site.
• The laboratory work will be divided in five (5) modules.
• The modules will follow the class topics and will be related to the reactions that are being studied in the lecture component of CHEM2402.
• All data needed for the laboratory module will be provided via Brightspace. Each lab will have a lab report that will be uploaded to Brightspace for grading. More details on the labs and lab reports can be found in Brightspace.
•No lab exemption will be given for the virtual labs in 2021.

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Course Assessment

A minimum mark of 40% must be obtained on the final examination in CHEM2402 to pass the class. Any mark less than 40% on the final examination in CHEM2402 will automatically result in a grade of "F" in CHEM2402.
A minimum grade of 7.5/15 is required in the laboratory portion of CHEM2402 to pass the class.
A minimum grade of 40/100 marks for the final examination is required in CHEM2402 to pass the class.
A minimum total grade of 50/100 marks for the combined class material is required in *CHEM2402 to pass the class*.

Course Assessment:	total
Online Quizzes	30%
An assignment	15%
Final examination	40%
Laboratory	15%
Total	**100%**

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	**B+** (77-79)	**C+** (65-69)	**D**	(50-54)
A (85-89)	**B** (73-76)	**C** (60-64)	**F**	(<50)
A- (80-84)	**B-** (70-72)	**C-** (55-59)		

Dates of online assignments:

Six online quizzes will be assigned throughout the term. Each topic will have an associated quiz that must be done within the time allowed for the quiz. Each quiz will be independently graded for 5% of the final grade and the total grade for the online quizzes will be 30% of the final grade. All quizzes must be completed.

The term assignment will be handed out on March 10, 2021 and there will be 32 hours to complete the assignment and upload the answers to Brightspace before the deadline on March 11, 2021. Only the uploaded paper to Brightspace will be graded. Errors in the uploads to Brightspace are the responsibility of the student and therefore students much check their uploaded paper to ensure the upload is the correct version and completed document for grading.

Final Examination (time and place to be scheduled by the Registrar) will be a three-hour exam and will cover the entire course. The three-hour final examination (scheduled by the Registrar) will cover the entire course. The final examination may include some questions from the laboratory portion of the course and may include reactions covered in CHEM2401. A student may write a make-up final examination if the final examination was missed with a justifiable, documented reason. The date and time of the make-up examination will be decided a few days after the CHEM2402 final examination has been written and will be at the end of the regular examination period. The student is responsible to contact the Principal Instructor at CHEM2400@dal.ca to arrange the make-up final examination in CHEM2402. The Principal Instructor will not contact the student. Failure to contact the Principal Instructor prior to the final examination date or within 24 hours after the final examination and to provide appropriate documentation for the missed final examination will result in a grade of 'INC' for CHEM2402. CHEM2402 has no supplementary examination. The University policy is that final examinations are not returned to students.

Course Policies

Announcements. Class notifications and updates will be posted to the announcements on Brightspace.
Delayed Content. In the case of a weather-related closure, internet or power interruptions, online content may be delayed.

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Course Content
Lectures. The following topics are expected to be covered in CHEM2402 and are listed below.

Nomenclature. Review the material from CHEM2401. Synopses on drawing organic molecules and nomenclature are now available on the Brightspace site. You should review this material.

Spectroscopy. Review the material on nuclear magnetic resonance (^{1}H and ^{13}C NMR) spectroscopy from CHEM2401. Chapters 13, and 14

A list of Chapter sections will be available on Brightspace and is subject to change.

Review of Organic fundamentals and S_N1, S_N2, E1 and E2 reactions Chapters 1, 2, 3, 4 and 9.

Alkenes and alkynes Chapters 5, 6 and 7

Alcohols and ethers. Chapter 10.

Organocuprates. Chapter 11.

Carboxylic Acids and Derivatives. Chapter 15.

Aldehydes and Ketones. Chapter 16.

Imines and Enamines. Chapter 16.

Reactions of Aromatics. Chapters 8 and 18.

Developing Organic Synthesis. Chapter 18.

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Faculty of Science Course Syllabus (Section B)
Organic Chemistry II CHEM2402

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.
Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).
Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.
Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness
Statement: http://www.dal.ca/cultureofrespect.html

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).
Information: https://www.dal.ca/campus_life/communities/indigenous.html

Important Dates in the Academic Year (including add/drop dates)
https://www.dal.ca/academics/important_dates.html

University Grading Practices
https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Missed or Late Academic Requirements due to Student Absence (policy)
https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html

Student Resources and Support

Advising

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: https://www.dal.ca/faculty/science/current-students/academic-advising.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Black Students Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports

Library: https://libraries.dal.ca/

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Copyright Office: https://libraries.dal.ca/services/copyright-office.html

Fair Dealing Guidelines https://libraries.dal.ca/services/copyright-office/fair-dealing.html

Other supports and services

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html

Student Advocacy: https://dsu.ca/dsas

Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Safety

Biosafety: https://www.dal.ca/dept/safety/programs-services/biosafety.html

Chemical Safety: https://www.dal.ca/dept/safety/programs-services/chemical-safety.html

Radiation Safety: https://www.dal.ca/dept/safety/programs-services/radiation-safety.html

Scent-Free Program: https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html