

Faculty of Science Course Syllabus

Department of Chemistry Physical Organic Chemistry and Spectroscopy CHEM 3404 Fall 2019

Instructor(s): Professor Frances Cozens, Room 410, frances.cozens@dal.ca.

Office hours: Mondays, Wednesday and Fridays 12:30 pm – 1:30 pm. You are also welcome to e-mail me if you would like to make an appointment for a specific time. Please put CHEM3404 in the subject line.

Dr. Reinaldo Moya-Barrios, Room 1053, rbarrios@dal.ca.

Laboratory instructor, day-to-day supervision and all administrative matters for the CHEM3404 laboratories.

Lectures: Chemistry Building, Room 223, Monday, Wednesday and Friday, 11:35 am - 12:25 pm

Laboratories: Sproull Organic Chemistry Laboratory, Monday or Thursday 1:30 - 5:30 pm. Labs run once a week for four hours.

The following pages constitute the syllabus for this course, CHEM3404. 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 instructor with any questions and/or concerns you may have.

Course Description: Credit hours: 3 Format: Lecture and Lab Hours weekly: 7

This course provides an introduction to concepts in physical organic chemistry that are used to explain structure-reactivity relationships. Spectroscopic techniques are also described with an emphasis on NMR spectroscopy. The organic laboratory will focus on the separation and spectroscopic identification of organic compounds, and on experiments that introduce fundamental concepts in physical organic chemistry.

Course Prerequisites:

PREREQUISITES: CHEM 2401.03/2402.03 or equivalent (grade of C- or better)

Course Objectives/Learning Outcomes:

1) Spectroscopy:

- ability to interpret spectroscopic data for organic compound identification.

2) Physical Organic Chemistry:

- understand the effect of substituents in organic chemistry
- predict mechanisms and transition state structures
- fully appreciate complexities of nucleophilic substitution reactions
- recall structures and properties of select reactive intermediates

Course Materials:

Lectures:

- **Class notes** will normally be available on the Brightspace class website shortly before the lecture. NOTE: Lectures notes subject to change. The latest version of the class notes will be posted to Brightspace.
- **Textbook:** "*Advanced Organic Chemistry, 5th Edition, Part A: Structure and Mechanisms*", by Carey and Sundberg, Springer, 2007 is a valuable reference book for this class. This book is **available on-line to Dalhousie students** in the library or logged-in via VPN. This book has a great deal of useful information and should be part of student resources. A PDF of some relevant pages will be uploaded to Brightspace. <http://lib.mylibrary.com.ezproxy.library.dal.ca/Open.aspx?id=4318>
- **Resource** "*Introduction to Spectroscopy, 4th or 5th Edition*", by Donald L. Pavia, Gary M. Lampman, George S. Kriz and James A. Vyvyan, 2009 or 2014. A copy of the 4th Edition text will be available in the Advanced Resource Center.
- **Practice problems.** Practice problems will be available on Brightspace for both Physical Organic Chemistry and Spectroscopy modules. These problems are extremely important to complete for the successful completion of CHEM3404. Answers will also be posted to Brightspace.

Laboratory:

- CHEM3404 Laboratory Manual, Fall 2019 (**required**)
- Bound laboratory notebook (**required**)
- Safety glasses (**required**, including students with prescription glasses)
- Approved laboratory coat (**required**)
- **WHMIS**, or the Workplace Hazardous Materials Information System, is a global harmonized system used to classify and label hazards and regulate handling procedures within industry and academic fields, especially those in science. Regardless of your chosen field of study within science being familiar with WHMIS is a significant asset. As such, the Department of Chemistry requires ALL students participating in their laboratory programs to complete WHMIS 2015 training provided by the Environmental Health and Safety Office. This training course is provided through the Dalhousie College of Continuing Education. Upon completion of your WHMIS 2015 course you will receive a Letter of Completion (as a PDF document) via email from the College of Continuing Education (cceehs@dal.ca) within 3 business days. Please ensure that you register and complete the WHMIS course well in advance of the letter submission deadline. After you have received your Letter of Completion please upload the PDF document to the Brightspace site. Instructions on how to register for the course and upload your letter of completion can be found on the Brightspace Site. **The due date for a fall term class to complete the 2015 WHMIS training is September 29, 2019, 11:30 pm.**

Websites:**Databases**

- Web of Science Citation Databases (Chemistry search; Dalhousie library)
http://apps.webofknowledge.com/UA_GeneralSearch_input.do?product=UA&search_mode=GeneralSearch&SID=4CqG4ooiR25p7YLkk2&preferencesSaved=
- Scifinder Scholar (chemistry search; Dalhousie library)
<https://scifinder.cas.org/scifinder/login>
- Spectral Database for Organic Compounds
http://sdb.sdb.aist.go.jp/sdb/cgi-bin/cre_index.cgi

General Chemical Information

- Chemical Institute of Canada (www.cheminst.ca/)
- Royal Society of Chemistry (www.rsc.org)
- American Chemical Society (www.acs.org & pubs.acs.org)

Course Assessment:

Two in-class term tests	20% each
Final examination (3 hours)	40%
Laboratory (see lab manual for details)	20%
Total	100%

Dates of term tests: Friday, October 25, 2019 and Friday, November 29, 2019.

A minimum grade of 11/20 is required in the laboratory portion of CHEM3404 to pass the class.

The term tests and the final examination are all “closed book.” The final examination (time and place to be scheduled by the Registrar) will be a three-hour exam and will cover the whole course. The term tests will be given during regular class time.

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)	

Chemistry courses, unless stated otherwise, have a minimum grade requirement of C- for their prerequisite chemistry courses. Students with grades below C- in the prerequisite chemistry courses can only register with the permission of the instructor for the course.

Course Policies

Emergencies

Missed or Late Academic Requirements due to Student Absence:

Dalhousie students are asked to take responsibility for their own short-term absences (3 days or less) by contacting their instructor by email prior to the academic requirement deadline or scheduled time and by submitting a completed Student Declaration of Absence to their instructor in case of missed or late academic requirements. Only 2 separate Student Declaration of Absence forms may be submitted per course during a term. (read more:

[https://cdn.dal.ca/content/dam/dalhousie/pdf/dept/university_secretariat/policy-repository/StudentAbsenceRegulation\(OCT2017\)v2.pdf](https://cdn.dal.ca/content/dam/dalhousie/pdf/dept/university_secretariat/policy-repository/StudentAbsenceRegulation(OCT2017)v2.pdf))

The policy does not apply to final exams scheduled by the Registrar's Office.

There will be no make-up midterm tests in CHEM3404. If you are ill or experiencing an extreme personal emergency at the time of a midterm test, email Dr. Cozens to inform her of the situation. In addition, please complete a Student Declaration of Absence, as per the regulations in the Dalhousie University Calendar. In the case of an excused midterm test due to illness or another prearranged situation, the value of your final exam will be adjusted to account for the missing marks. If you are too ill to write the final examination in this class, please arrange for a medical certificate, as per the regulations in the Dalhousie University Calendar. Students who are ill for the final exam and produce a medical certificate will have an opportunity to write a make-up exam. (See the University Regulations published in the most recent undergraduate calendar).

Email.

It is your responsibility to read your Dalhousie email, as class notifications may be sent by email. For any correspondence in CHEM3404 please use email to contact Dr. Cozens or Dr. Moya-Barrios.

Cancelled Classes.

In the case of a weather-related closure of the University, a DalAlert email will be sent to all students, faculty and staff. Other information can be found at www.dal.ca/storm.html. In the event that CHEM3404 needs to be cancelled, notification will be sent by email and a notice will be placed on the door to the classroom door.

Course Content

Lectures. The following topics are expected to be covered in CHEM3404 and are listed below. Class lecture notes will be available on Brightspace.

Part 1: Spectroscopy

UV-Vis Spectroscopy

IR Spectroscopy

Mass Spectrometry

NMR Spectroscopy

Part 2: Physical Organic Chemistry

Substituent effects

Hammett equations and other free energy relationships.

Energy Diagrams

Transition state structure and the Hammond Postulate.

Kinetic Isotope Effects

Origin and use in determining reaction mechanisms and transition state structure.

Nucleophilic Substitution Reactions

S_N1 and S_N2 reactions, leaving group ability, nucleophile ability.

Carbocations

Reactivity and stability.

Other reactive Intermediates (time permitted)

Chemistry of radicals, carbenes and carbanions

Any other physical organic topic

Faculty of Science Course Syllabus (Section B)

CHEM3404

University Policies, Statements, Guidelines

This course is governed by the academic rules and regulations set forth in the University Calendar and the Senate. <https://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog>

Statements

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

University Policies and Programs

Important Dates in the Academic Year (including add/drop dates)

http://www.dal.ca/academics/important_dates.html

Dalhousie University's Grading Practices Policy

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html o Scent-Free Program <http://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>

Faculty Information: Student Self-Declaration of Absence

https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/academic-policies/student-absence/student-absence---for-faculty.html

Safety (excerpts emphasized as appropriate to discipline/course)

* Biosafety (<http://www.dal.ca/dept/safety/programs-services/biosafety.html>)

* Research Laboratory Safety Policy Manual (<http://www.dal.ca/dept/safety/documents-policies-procedures.html>)

* Laboratory Chemical Safety Manual <http://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

* Radiation Safety Manual <http://www.dal.ca/dept/safety/programs-services/radiation-safety.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 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