

**CONCORDIA UNIVERSITY**  
**DEPARTMENT OF CHEMISTRY & BIOCHEMISTRY**  
**CHEMISTRY 324/51 - ORGANIC CHEMISTRY III: ORGANIC REACTIONS**

This course aims at presenting a mechanistic survey of reactions of major synthetic utility. The focus is on reactions involving formation of carbon-carbon bond, although a good knowledge of functional group transformation is required. It is the third course in the sequence following **Introductory Organic Chemistry I and II**, which, at Concordia, covers a great variety of reactions involving transformations of functional groups and some carbon-carbon reactions. This course will review both of them and expand greatly on the formation of carbon-carbon bonds, touching to some extent on its use in synthesis.

**COURSE FORMAT:** Lecture (Videos, slides, and group work) and laboratory.

**INSTRUCTOR:** Sébastien Robidoux                      Lec. 51: Tu 18:00-20:30 HC-157  
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**OFFICE HOURS:** Monday              10H30-12H00                      Wednesday      10H30-12H00  
Friday                      10H30-12H00

**AUDIENCE:** This course is part of the core component for both chemistry and biochemistry programs at Concordia. This means that all students enrolled in the Major, the Specialization and the Honours programs offered by the department of chemistry and biochemistry must take it.

**CONTENT:** This course is divided into 6 topics covered over 24 lectures.

1. Review (6.5 lectures)
2. Pericyclic reactions (5 lectures)
3. Reactions of organometallic compounds (3.5 lectures)
4. Alkynes (Home preparation)
5. Reactions of enolates, enols and enamines (7 lectures)
6. Reaction of organo-phosphorus and organo-sulfur stabilized carbanions (2 lectures)

The review will present some basic reactions and their respective selectivities (chemo-, regio-, and stereo-). It will also briefly summarize the concept of acidity, of molecular orbital theory, of thermodynamic and kinetic of reactions; all with the objective of understanding and predicting mechanisms and overall outcome of reactions. The review will also give time for students to get acquainted with organic chemistry in the event that the previous course had been completed more than one year ago. There will be new material presented in the review.

The last four topics will each present different types of reactions. These are useful in synthesis because they allow forming new carbon-carbon bonds with different selectivities. The focus will be on the mechanisms and the explanation for the selectivities observed. Students will also have to be able to devise, using these types of reaction, the synthesis of a medium-sized compounds.

**STATEMENT OF OBJECTIVES:** By the end of this course, successful students should be able to:

- identify and visually represent most functional groups and discuss their properties and reactivities. (Intermediate to advanced level)
- draw mechanisms for the reactions covered in class. (Basic to advanced level)
- Predict the chemo-, regio-, and stereoselectivities for all reactions covered in class, in CHEM 221, and in CHEM 222 using steric and electronic effects. (Basic to intermediate level)

- explain the chemo-, regio-, and stereo-selectivities for the reactions covered in class using steric and electronic effects. (Basic to intermediate level)
- design a 10-20 step synthesis using the principles of chemo-, regio-, and stereoselectivities. (Basic to intermediate level)
- use correct laboratory procedures to synthesize, purify, isolate, and characterize simple organic molecules. (Intermediate level)
- write a laboratory report to communicate experimental results in a scientific format. (Intermediate level)

**ACCESSIBILITY:** As the instructor of this class, I will strive to make the learning experience in this classroom as accessible and inclusive as possible. Students who know that this course might offer challenges are invited to contact me to discuss their concerns and the possible means and strategies that can be applied to attain the objectives stated previously. However, if you have accessibility needs that require academic accommodations, please meet with an advisor from the Access Centre for Students with Disabilities (ACSD) as soon as possible. The ACSD advisor will review your documentation and set an accommodation plan with you. As a student registered with the ACSD, you may have access to e-textbooks and course packs. Please enquire with the accessibility advisor. I welcome meeting with you to discuss your accommodations.

ACSD Contact information: [acsinfo@concordia.ca](mailto:acsinfo@concordia.ca); 514-848-2424 ext. 3525; SGW Campus, GM-300.

<http://www.concordia.ca/students/accessibility.html>

**TEXTBOOKS:** There is a coursepack required for the theory section of the course: Organic III: Organic reactions. You can buy a hard copy or a digital copy, both available at the bookstore. It is also assumed that you have access to a standard textbook of organic chemistry, such as Organic Chemistry by Jones, Bruice, or any other ones.

**EXAMINATIONS:** There will be **FOUR** formal examinations:

1. Test 1 in **CLASS designed for 45 minutes but will last 1H15 minutes** for 3 questions on: October 16, 2018 (Review and pericyclic reactions)
2. Test 2 in **CLASS designed for 45 minutes but will last 1H15 minutes** for 3 questions on: November 6, 2018 (Organometallics and acetylide)

If a student is absent from the tests, she/he must produce a written excuse appropriately signed (i.e. by a doctor, or an employer) on the appropriate letterhead paper. This letter must be delivered to the instructor **NO LATER THAN ONE (1) WEEK AFTER THE TEST**. The Department determines the validity of the absence. If there is no valid excuse, the student will receive a mark of zero for the test. There is no makeup test. In case of a valid excuse, percentage grade is transferred unto the final exam.

3. A final examination, between December 5 and December 19, 2018, arranged by the Examinations Office.
4. A laboratory exam on **MOODLE, 30 minutes** for 10 multiple choice questions and 5 short answer questions. It must be done between Friday November 23<sup>rd</sup> 18H30 and Monday November 26<sup>th</sup> 18H30.

**Surprise quiz:** 5 or 6 surprise quizzes will be given during the term. Each of them will include 1 or 2 simple questions related to material covered in the previous lecture. Students will have between 5 and 10 minutes to complete the quiz. The worst grade will be dropped in order to count the best 4 or 5 grades. Attendance will be judged on the number of quizzes completed. If you feel that the format of the quiz will not give you a fair opportunity at showing your knowledge, speak with the professor.

**DALITE:** DALITE is a database of multiple choice questions selected to review the content of Introductory Organic Chemistry I and II. There will be 0.2% allowed per questions fully answered (one choice + one rationale and a second choice). You will have to provide a rationale for your first answer. You will then be confronted with another rationale from the database and will have to submit another answer. You do not have to be correct to get the part mark. You need to answer 25 questions in order to get the maximum of 5%. You can answer more questions if you want! You can access the DALITE's questions on Moodle starting Friday, September 7<sup>th</sup>, 9H00 until Monday, September 24<sup>th</sup> 18H30.

**COURSE GRADE:** The final grade of the course is based on the marks obtained in the examinations, quizzes and the laboratory marks. The composition of the final grade is as follows:

DALITE	5%
Surprise quiz (best 4-5 out of 5-6)	10%
Attendance	5%
Test 1	12.5%
Test 2	12.5%
Final exam	30%
Lab reports	15%
Lab examination	10%
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	100%

*Separate minimum passing marks are required for theory (weighted average of 2 tests, final exam, attendance, surprise quizzes, and DALITE), for lab (weighted average of lab report and lab exam) and for lab exam. Minimum passing marks for lab exam and theory is 50% (D) and for lab is 60% (C-).*

Letter grades will be assigned according to the following criteria:

A+: 90.00-100.00	A: 85.00-89.99	A-: 80.00-84.99
B+: 76.67-79.99	B: 73.33-76.66	B-: 70.00-73.32
C+: 66.67-70.00	C: 63.33-66.66	C-: 60.00-63.32
D+: 55.00-60.00	D: 50.00-55.00	F: see previous paragraph

**LABORATORY INFORMATION:** Laboratory Coordinator: Ms Rita Umbrasas, SP-330.01, Tel. 848-2424 ext. 3354, Email: [rita.umbrasas@concordia.ca](mailto:rita.umbrasas@concordia.ca) Chem. 324 Laboratories are located at SP-112.

**Laboratories start the week of Monday, September 10, 2018.** All students must attend the section for which they are registered during this week.

*Laboratory performance is graded based on the quality of the experimental work, the laboratory reports and a laboratory exam.*

Do not expect a particular laboratory experiment to be directly related to the material covered in the lectures of the preceding week. **CONSIDER THE LABORATORY WORK AS AN INDEPENDENT AND ADDITIONAL LEARNING EXPERIENCE.**

**LABORATORY MANUAL & MATERIALS:** The lab manual for the course is: **Operational Organic Chemistry**, a problem-solving approach to the laboratory course" Lehman, John W. 4<sup>th</sup> Edition, Prentice Hall, 2009. This is **NOT** available anymore and a **coursepack** containing the information can be bought from the University Bookstore. Other items such as lab coats and safety glasses, and a lab note book are mandatory and can be purchased from the bookstore.

**LAB CONTENT:** The laboratory component of the course is divided into 6 experiments and 1 tutorial spread over 11 weeks.

1. Nucleophilic Substitution of 2,4-Dinitrochlorobenzene (1 week)

2. Kinetic versus Thermodynamic Control in Competing Reactions (2 weeks)
3. Using the Chemical Literature in an Organic Synthesis (Library Visit) (1 week)
4. Synthesis of 7,7- Dichloronorcarane using a phase transfer catalyst (1 week)
5. Preparation of the Insect Repellent N,N-Diethyl-m-Toluamide (2 weeks)
6. Synthesis of Dimedone and Measurement of its Tautomeric Equilibrium Constant (1.5 weeks)
7. Effect or Reaction Conditions on the Condensation of Furfural with Cyclopentanones (2.5 weeks)

The objective of the first three experiments/tutorial is to get yourself familiarize with the laboratory basic procedures, the library and online searches, and the proper way to write a laboratory report; all of this within an organic chemistry framework. The subsequent experiments (4-7) are touching on more advanced techniques, or topics related to the theory of the course or with important techniques and concepts in organic chemistry. There will be a lab report to write for every experiment. You are invited to consult the laboratory manual for more information on how to write a lab report.

**LABORATORY INSTRUCTORS (TEACHING ASSISTANTS):** Each laboratory section will have one demonstrator who is a graduate student. You must know his name, email and the location of his room. You will need to contact your teaching assistant for matters related to your labs.

**TUTORIAL SESSIONS:** Collaborative study sessions accompany this class. Attendance at these is voluntary but strongly encouraged. More details about this will be given in class.

**MANDATORY QUIZ AND SEMINAR:** As part of this course, you are *required* to i) attend a Chemistry and Biochemistry Departmental Seminar on the academic conduct code and the appropriate use of information sources and ii) pass the online quiz associated with this seminar (the passing grade for the quiz is 100%). (**Note:** This is **not** the University's quiz you may have been asked to take when you first registered and logged into the myConcordia portal; the one you must take is similar, but graded by the Department of Chemistry and Biochemistry, and you do not have access to it until after you have attended the seminar.) The aim of this seminar is to clarify the academic conduct code in terms of what practices will be considered unacceptable with regards to work submitted for grading in Chemistry and Biochemistry courses. **You are only exempt from repeating the seminar and the quiz if you have done both in Fall 2013 or more recently,\*** otherwise you are required to repeat both this term. This short seminar (1 hour) will be held at the following times (note that late-comers will **not** be admitted):

Date	Time	Room
Monday, Sept. 24	16:45-17:45	HC 155
Tuesday, Sept. 25	16:45-17:45	CC 116
Tuesday, Sept. 25	20:45-21:45	HB 130
Wednesday, Sept. 26	16:45-17:45	HC 155
Wednesday, Sept. 26	20:45-21:45	SP S110
Thursday, Sept. 27	16:45-17:45	CC 115
Friday, Sept. 28	16:45-17:45	HB 130

As space for each of the seminars is limited by the room size, please **sign up** to your preferred time as soon as possible (slots fill up quickly). Sign-up sheets are available two weeks in advance of the seminars outside SP 201.01 (Departmental office). Only sign up in **available slots**: rooms must not be filled over capacity!

***If you do not complete this course requirement, your final grade for the course may be lowered by one***

***full letter grade with an incomplete (INC) notation until such time as this requirement is completed. Please refer to the undergraduate calendar (section 16.3.6) for details on removal of an incomplete notation.***

*\* You are exempt if you can locate your ID in the pdf file located on the Departmental web site (<http://www.concordia.ca/content/dam/artsci/chemistry/docs/Compliance-list.pdf>).*

**PLAGIARISM AND OTHER FORMS OF ACADEMIC DISHONESTY:** The Academic Code of Conduct can be found in section 17.10 of the academic calendar (<http://www.concordia.ca/academics/undergraduate/calendar/current/17-10.html>). Any form of unauthorized collaboration, cheating, copying or plagiarism found in this course will be reported and the appropriate sanctions applied. The mandatory seminar is a clear and fair opportunity to learn what our faculty regards as academic misconduct. Failure to take part in this learning opportunity and thus ignorance of these regulations is no excuse and will not result in a reduced sanction in any case where academic misconduct is observed.

**COURSE NUMBER & SECTIONS:** Make it a point to remember the *course number*, your *lecture section number* and your *lab section number* for the duration of the course. This information will be required frequently later when you have to fill in your answer books during examinations and when submitting lab reports, etc., to ensure that your grades are correctly recorded.

**LAB EXEMPTIONS:** Students, who are repeating the course, having passed the lab component within the past two (2) years, may be eligible for a lab exemption. Applications for the exemption (forms available in SP201.01) must be completed by the end of the first week of term (*i.e.* prior to the start of the laboratory); late applications will not be accepted. Signed and completed forms are to be returned to Hilary Scuffell, (SP 275.01). Students **MUST** register for the appropriate lab exemption lab/tutorial section; students registered in any other lab/tutorial sections will be required to complete the lab portion of the course (NO EXCEPTIONS).

**COURSE WITHDRAWALS:** Students who withdraw from the course must also check-out from their laboratory section. Only those students registered in the course may attend the laboratory and receive a grade for lab work.

**TYPES OF QUESTIONS**

	<b>Quiz</b>	<b>Test 1</b>	<b>Test 2</b>	<b>Final</b>	<b>Example 1</b>	<b>Example 2</b>
Identify and visually represent most functional groups and discuss their properties and reactivities. (Intermediate to advanced level)	Yes	Yes (1)	Yes (1)	Yes (2)	Sample Test 1 Question 3	Sample Final Questions 4 and 7
Draw mechanisms for the reactions covered in class. (Basic to advanced level)	Yes	Yes (1)	Yes (1)	Yes (4-5)	Sample Test 1 Questions 1 and 2	Sample Final Questions 2, 9, 10, 11, and 12
Predict the chemo-, regio-, and stereoselectivities for all reactions covered in class, in CHEM 221, and in CHEM 222 using steric and electronic effects. (Basic to intermediate level)	Yes	Yes (1)	Yes (1)	Yes (4-5)	Sample Tests 2 Question 2	Sample Final Questions 5,8, 9, 10, and 12
Explain the chemo-, regio-, and stereo-selectivities for the reactions covered in class using steric and electronic effects.	Yes	Yes (1)	Yes (1)	Yes (3-5)	Sample Test 1 Question 2	Sample Final Questions 2, 9, 10, 11, and 12
Design a 10-20 step synthesis using the principles of chemo-, regio-, and stereoselectivities. (Basic to intermediate level)	Yes	No	Yes (1)	Yes (2-3)	Sample Tests 2 Question 1	Sample Final Questions 1,3, and 6