CHEM 3201: Advanced Organic Chemistry I
Fall 2022
Prospectus
PRELIMINARY VERSION (Last Updated: June 21)

Who:

Prof. Dr. Jeff Manthorpe
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Online and In-Person Office Hours: To be determined
TA contact information: To be announced

What:

Course Objectives: The overall objective of this course is to learn how to determine the structure of small organic molecules that contain the elements C, H, N, O, S, Si, P, F, Cl, Br, and/or I. This involves several techniques: elemental analysis, mass spectrometry, infrared spectroscopy, nuclear magnetic resonance spectroscopy, and ultraviolet spectroscopy (and they will be covered in that order).

Structure determination involves three steps:

1. Determination of **molecular formula** or several possible formulae
2. Determination of **functional groups** present in the molecule
3. Determination of **bond connectivity** (how the different pieces of the molecule connected together)

Topics to be Covered (in order)

Chapter In Text	Topic (Step(s) Associated with that Technique)	Approx. Dates	Midterm/Final Exam Coverage			
1	Molecular Formulae/Elemental Analysis (**Step 1**)	Sep 7, 12, 14	MT I	MT II	MT III	Final
3	Mass spectrometry: Part 1 – basic theory, instrumentation, and sampling techniques (**primarily Step 1**)	Sep 12, 14, 19				
4	Mass spectrometry: Part 2 – fragmentation and structural analysis (**primarily step 1 but also to a minor extent steps 2 and 3**)	Sep 19, 21, 26				
2	IR (infrared) spectroscopy (**primary technique for Step 2**)	Sep 26, 28				
5	NMR (Nuclear Magnetic Resonance) spectroscopy: part 1 – basic concepts and ^{1}H NMR (**Step 3 but can be related to steps 1 and 2 as well**)	Oct 3, 12, 17				
6	NMR spectroscopy: part 2 – ^{13}C NMR (**Step 3 but can be related to steps 1 and 2 as well**)	Oct 17, 19, 31				
7	NMR spectroscopy: part 3 – Spin-spin coupling in NMR spectra (**Step 3**)	Oct 31, Nov 2, 7, 9				
8	NMR spectroscopy: part 4 – Other topics in 1D NMR – exchange processes, decoupling, nOe, conformational analysis, stereochemistry (**Step 3 but can be related to Steps 1 and 2 as well**)	Nov 14, 16				
9	NMR spectroscopy: part 5 – advanced NMR: 2D experiments (**Step 3**)	Nov 16, 21, 23, 28				
10	UV spectroscopy (**Steps 2 and 3**)	Nov 28, 30, Dec 5				
11	Combined spectral problem solving (**Steps 1, 2, and 3 because this chapter integrates all of the course material**)	Dec 5, 7, 9 (Fri, Dec 9 = Monday schedule)				

Why:

The ability to determine the identity of a compound is a fundamental, vital and critical skill of every chemist and biochemist. Think about it this way: If you don't know what you compound have, even if you can say fascinating and important things it does, you are missing a most basic piece of the story.

When and Where:

Lectures: Mondays 11:35 to 14:25 (Southam Hall, Room 304) **Note that room assignment may change*
Tutorials: Wednesdays 13:05 to 14:25 (Southam Hall, Room 304) **Note that room assignment may change*
Office Hours: To be determined.

Online Lecture/Tutorial Platform: ~~Zoom, unless we need to change. Links will be posted on Brightspace and sent via email.~~ I SURE AS HELL HOPE I NEVER NEED THIS HEADING AGAIN!

Important Dates *(Midterm dates are Tentative!)*:
Wednesday, September 7: First class (tutorial timeslot)
Monday, September 12: First lecture timeslot
Week of October 3 or 10 (tentative): Midterm I (after Chapter 2/Infrared Spectroscopy)
Saturday, October 22–Sunday, October 30: Fall break. No classes.
Week of October 31 (tentative): Midterm II (after Chapter 6/^{13}C NMR Spectroscopy)
Week of November 21 (tentative): Midterm III (after Chapter 8 or maybe Chapter 9)
Wednesday, December 7: Last tutorial
Friday, December 9: Last lecture/class (classes follow a Monday schedule to make up for Thanksgiving on October 10)
Saturday, December 10-Wednesday, December 22: Final Exam period.
A few days before Final Exam: 1 or 2 review sessions

DATE and TIME of the FINAL EXAM will be scheduled by the university during the final examination period (Dec 10-Dec 22). **The examination will be three hours in duration and will cover all of the course material (i.e., the exam will be cumulative).**

How:

Evaluation:	
Midterm Examination I	10%
Midterm Examination II	14%
Midterm Examination III	18%
Assignments (ca. 3-6)	18%
Final Examination	40%
Final Grade	100%

Examination format: Midterm exams will be held outside of class time. Practice exams and solutions will be posted on Brightspace. There will be special tutorials to go over the solutions to the practice exams, as well as your exams.
Important qualifier: A grade of at least 45% on the final exam is required to pass the course.

Lecture and Tutorial Formats: Lectures and tutorials will be synchronous but recorded and posted online for review and/or students who are unable to attend live.

Lecture material will be presented (both in videos and in class) in a combination of electronic slides and writing on the slides via a tablet or traditional chalkboard delivery. Slides will be available on Brightspace the day before class or earlier but usually will be available well in advance. Students are expected to print the slides and bring them to class or bring a tablet computer. An effort will be made to leave appropriately sized gaps in the slides so that additional material may be written in the appropriate place. Students are also expected to have some extra paper handy.

Brightspace: Brightspace will be used to distribute handouts (notes) and assignments. Brightspace email will be used to distribute notices regarding the class. Brightspace also has a discussion board that students can use to discuss problems and things related to the course. I will monitor and participate in these discussions. Please check it regularly. Any students who do not have access to Brightspace should speak to me ASAP to make alternate arrangements to receive class notices and handouts.

Handouts: ***Handouts should be printed with a MAXIMUM of 2 slides per page.*** Many slides contain images with critical details that cannot be seen if printed smaller than 2 slides per page. The slides do contain colour but can be printed in black and white. The colours have been chosen so that they will still appear reasonably well when printed in black and white.

Practice Problems: Problems associated with each chapter will be assigned by the instructor and will be drawn from the course textbook. It is the responsibility of the student to do these problems. They will not be handed in for grading. However, students are free (and encouraged) to ask questions of the instructor about the problems.

Assignments: There will be several assignments throughout the course that will be submitted for grading. The total value of the assignments will be 18% of your final grade; hence the value of each assignment will ultimately depend on the number of assignments. Assignments will be submitted via a dropbox on Brightspace.

> **All assignments must be done *individually!*** Students may work together on practice problems and are encouraged to do so. There will likely be an assignment accompanying most chapters of the course. This means that every week you will have something to do – either an assignment or a midterm exam; therefore ***IT IS IMPERATIVE THAT YOU KEEP UP WITH THE COURSE!*** *THE NUMBER ONE REASON STUDENTS DROP THIS COURSE IS THAT THEY FELL BEHIND!*

Midterm and Final Examinations: The midterm and final examinations will administered as outlined above. All exams are *open book* (you may use the course textbook but not your notes) and cumulative. *You **are** permitted to write notes in your textbook and use flags on useful pages*. ***You may not insert additional paper into your book.*** All students are required to write all the midterms (University policies on exemptions for illness, family emergencies, *etc*. and academic misconduct apply to midterm exams). Examinations and solutions and solutions from previous years will be made available through Brightspace for use as studying tools.

> ~~*****Use of e-Proctoring system:** This course has timed written assessments, which may consist of tests, midterms and/or final examinations. The Carleton University e-Proctoring system may be used in your assessments, and requires the use of a printer, webcams, microphones, and smart phones.~~

Textbooks and other required materials:

1) ***MANDATORY TEXTBOOK:*** **Introduction to Spectroscopy (fifth edition)** by Pavia, Lampman, Kriz, and Vyvyan (publisher: Brooks/Cole): The fourth edition is also acceptable but not recommended. The fifth edition contains more problems, including solved problems, and the topic of rewritten and restructured mass spectrometry. It is available at Haven Books (Ottawa) for $151 plus tax (to be updated). It is also available through online booksellers such as Chapters/Indigo and Amazon. The third edition is no longer acceptable; it is too outdated, lacks many of the problems, and contains too many errors.

There is an *international edition of the 4th edition*; however, be aware that it is printed on poorer quality paper and ***lacks the answers to the practice problems!!***

As the exams are open book, ELECTRONIC VERSIONS OF THE TEXTBOOK ARE NOT ACCEPTABLE. YOU MUST HAVE YOUR OWN HARDCOPY OF THE TEXTBOOK.

2) **Molecular Visions Model Kit (*Highly Recommended*)**: These molecular model kits are an excellent balance of affordability and accuracy. They are available online at http://www.molecularvisions.com/molecular-model-kits/cat_1.html (kit #1 for Canada, $29.25 (includes shipping)) or from the Carleton University bookstore. They are also useful for organometallic and inorganic chemistry—money well spent! They are also permitted on all examinations.

Prerequisites: *Carleton University students:* CHEM 2204 or 2206 or 2208. *Students of other universities:* Two one-semester organic chemistry courses. At most universities this will be either two courses in second year or one in first year and another in second year. *If you wish to take this course for credit at your institution be sure to obtain a letter of permission from your university.* If your university requires further information about this course please contact me (the instructor).

Students with Disabilities/Paul Menton Centre Registrants: Students registered with the Paul Menton Centre for Students with Disabilities at Carleton or the equivalent office at their institution will be adequately accommodated. However, students are hereby notified that in order to receive accommodation, they must present the appropriate paperwork (electronic or hard copy) to the instructor ***NO LATER THAN ONE WEEK IN ADVANCE***.

Academic Integrity: The consequences of copying, plagiarism, and other forms of cheating are substantial. The Carleton University Academic Integrity Policy can be found online at https://carleton.ca/senate/wp-content/uploads/Academic-Integrity-Policy1.pdf. It is **YOUR RESPONSIBILITY** to know the contents of these policies so it is highly recommended that you read them.
Within the context of this course, an academic integrity offence will automatically result in an F for a first offence. If you commit a second offence, the penalty is a one-year expulsion from your academic program. The penalty for a third offence is expulsion from the university.

In the last three years I had one offence in this course (CHEM 3201) and 12 offences in CHEM 3202. All 13 students were found guilty.

*****IT IS AN ACADEMIC INTEGRITY OFFENCE TO REPOST OR SHARE COURSE MATERIALS (including but not limited to course notes, assignments, exams, and/or solutions thereto) WITH PEOPLE AND/OR ONLINE RESOURCES OUTSIDE OF CARLETON UNIVERSITY.*** THIS APPLIES NOW AND IN THE FUTURE; i.e., if you post course materials somewhere online (e.g., Chegg) next fall, it is still an academic integrity offence and penalties will apply. This means at minimum, your credit in this course may be revoked.**

While the above policy may sound heavy-handed, it is actually for your benefit and the benefit of students in future years. The supply of exam and assignment questions in this course is not infinite. If the supply of questions of reasonable and appropriate difficulty is exhausted, there is little choice but to make questions more difficult. And you wouldn't want that, would you?

Time Demands and Tips for Success in this Course

– In order to be successful in this course you must spend an *average* of 10 hours per week working on it:
- – Attend the lectures and tutorials
- – Take 10 to 20 minutes before listening to a lecture and look over the notes
- – Spend 10 to 20 minutes after the lecture to review the day's notes
- – Set aside 2 hours a week to read that week's material from the textbook

– Set aside *at least 2 hours a week* to do the problems from the textbook
– ASK QUESTIONS!
– BE DISCIPLINED AND STAY ON SCHEDULE! DON'T FALL BEHIND!

Course Outline (Prospectus) Information on Academic Accommodations

Requests for Academic Accommodation
You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

Pregnancy obligation
Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: **carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf**

Religious obligation
Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: **carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf**

Academic Accommodations for Students with Disabilities
If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. **carleton.ca/pmc**

Survivors of Sexual Violence
As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and is survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: **carleton.ca/sexual-violence-support**

Accommodation for Student Activities
Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist.
https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf

For more information on academic accommodation, please contact the departmental administrator or visit: **students.carleton.ca/course-outline**