CHM 522 – Advanced Organic Chemistry II | Syllabus | Spring 2024

Instructor: Lorenzo Mosca
Class Meetings: Tu-Th 12:30 pm – 1:45 pm
Where: Beaupre 215 – in person

Office Hours: Office hours by appointment. Feel free to drop by my office.
Where: Beaupre 325D
Contacts: lorenzo@uri.edu, **put CHM 522** in the object.
(401) 874-2364
Office: Beaupre 325D

Textbook(s): There are a variety of perfectly good textbooks that satisfy the needs of this course. You can get none, or all. We'll use course materials in the form of handouts, slides, and practice problems.

→ **March's Advanced Organic Chemistry**
Michael B. Smith, Jerry March – Wiley. Any edition from the 5th onward is perfectly good. The 8th edition (newest) is quite pricey, so look out for used books deals.

→ Advanced Organic Chemistry, Part B: Reaction and Synthesis
Francis A. Carey, Richard J. Sundberg – Springer, 4th or 5th editions.

→ **Modern Methods of Organic Syntheses**
William Carruthers, Iain Coldham – Cambridge University Press, 4th edition, 2004.

→ **Organic Syntheses: The Disconnection Approach**
Paul Wyatt, Stuart Warren – Wiley, 2nd edition, 2011. A must-read book!

→ Organic Syntheses: Strategy and Control
Paul Wyatt, Stuart Warren – Wiley, 2007

These last three books are 10+ years old, but still do a decent job and can be found for little money through used book online stores. **My favorites are in bold**.

Other materials: DO Take this 15-hour course on Coursera: https://www.coursera.org/learn/learning-how-to-learn Sign up for the free version (without certificate). This course is offered by an engineer and a neuroscientist specifically for learners in STEM at any level; plus, it's very dorky.

Course pre-reqs: CHM 427 or 505 or 521. Otherwise, request permission from the instructor.

Course requirements (* contributes to grade):

→ Lecture attendance will not be taken but is strongly encouraged (see policies).
→ 3 take home quizzes (*)
→ 4 15-min pop quizzes (*)
→ Review paper (*)
→ Final presentation (*)

Class Calendar | Dates and Reminders

01/22/24	**M**	**First day of classes | NO CHM 522**
01/23/24	**T**	**First day of CHM 522**
03/10/24	S	Spring Break
03/16/24	F	End of Spring Break
02/22/24	Th	*Review paper topic due*
03/21/24	Th	*Final presentation topic due*
04/11/24	Th	*Review paper due*
04/29/24	**M**	**Last day of classes**
04/30/24	T	Reading Day or Class make-up day
05/07/24	T	CHM 522 Final – Final Presentations

Course Aims

This course is based on two fundamental truths:

→ Most organic molecules can be built using multiple synthetic pathways.

and

→ One of these pathways is more logical and efficient than others.

Each reaction used to build a molecule needs to make sense regarding the previous and subsequent steps. Stereo-, regio- and chemo-selectivity effects must be considered at each step.

In this course we become better synthetic organic chemists by selecting appropriate organic reactions to build molecules in multi-step fashion. In doing so we will explore modern developments for the formation of C–C bonds and C–X bonds.

Topics: Everything that fits

• Bonding effects in chemistry • Aromaticity concepts • Acidity and basicity concepts • Thermodynamics and kinetics concepts • Reductions • Oxidations • Advanced functional group transformations • Protective groups • The science of synthesis: retrosynthesis • Lithium-halogen Exchange • Organolithium chemistry • Directed metalations • Magnesium-halogen exchange • Birch reductions • Alkylation of enolates • Directed aldol reaction • Stille, Suzuki, Heck Reactions • Allylation reactions • Synthesis of chiral amines • Addition to carbonyl compounds • Organozinc reagents • Asymmetric hydrogenations: Noyori's Hydrogenation • Stereoselective Olefinations: Wittig, HWE, Peterson, Tebbe, Juliá • Zirconation • C–N bond forming reactions • C–O bond forming reactions • Epoxidations and dihydroxylations • Pericyclic reactions • Cycloadditions • Asymmetric Diels-Alder reactions • Anionic cyclizations • Cyclopropanations • Cyclobutanes • 5-membered rings by radical cyclizations • The olefin metathesis reactions • Ring contractions •

Your path as a graduate student requires the ability to critically review primary literature. In turn, this requires being able to search for it, identify critical points, and discuss / present them. This is even more important in a fast-paced field like organic chemistry. *To pass this course*, you must complete both **Review Paper** and **Final Presentation** projects (→ see rubrics).

Review Paper: You must choose a topic in organic chemistry of relevance to you or your research work. However, I do not allow a topic that is simply a major subset of your research work. I suggest to focus on a very specific and narrow field, for example "*organocatalytic thioureas for asymmetric aldol reactions*", or "*bismuth(III) triflate as a Lewis acid catalyst in arylations*". You should submit your draft topic to me by Thursday 02/22/24, however, you may elect to change it later. Work toward writing a review paper that contains a minimum of 25 references to the topic, and that is between 5 and 10 pages long (font size: 11, single line spacing), excluding the references and figures. You may use *Chem.Soc.Rev.*, *Chem.Rev.*, *Acc.Chem.Res.* or the *Nat.Rev.* family as inspiration (among others). Each page should have at least one figure/scheme/chart/table (redrawn, when possible, especially reaction schemes). The paper should include an abstract (200 words). Start working on it immediately! Send drafts to me when you can, so that we can adjust it along the way. A template with more detailed instructions will be provided at the beginning of the semester. (→ *see rubrics*)

Final Presentation: Your **Final Examination** includes a 35-minute-long presentation on a topic in organic chemistry that is different from your Review Paper (although there might be connections to it). You can choose virtually any category: reactions (i.e., "*Juliá-Colonna epoxidation reaction*"), people (i.e., "*the works of Bob Grubbs*"), companies (i.e., "*Modern Reverse Transcriptase Inhibitors from Gilead*"), concepts (i.e., "*models of nucleophilic addition to carbonyls*"). You will present this in front of the class as your final work and receive feedback that will be counted toward your grade. Your **final presentation** ends with a 20-minute-long discussion, or "**chalk-talk**", in the form of Q&A. This extends concepts you have presented in your presentation to the materials covered during the class. This phase is comprehensive and requires mastery of basic concepts of organic chemistry. Therefore, you must be able to field reasonable questions regarding the chemistry covered in CHM 522. (→ *see rubrics*)

Take-home Exams: There will be three (3) take-home examinations as part of your evaluation. You should be able to solve the majority of the problems in about 2 hours of time. Take home exams will be assigned after class on Thursdays and should be returned (either in printed form or scanned and sent to me via email) by the following Monday @12:00 pm (noon). While it is absolutely viable that you may want to discuss part of the exam with your fellow students, be mindful that this is an individual evaluation and blatantly evident group work will be graded as such.

Pop Quizzes: There will be four (4) pop quizzes, given at the beginning of a class period. These are designed to test the class on progress and self-assessment. They contribute a little to the final grade (about 10% of the total), therefore I will drop the lowest grade out of 4.

Grading – Your final grade will be computed against a total of 700 points, distributed as follows:

① Take-Home Exams (3 × 100 points)
② Pop Quizzes (4 × 20 points, drop lowest)
③ Review Paper (170 points)
④ Final Presentation (170 points)

I will grade according to a scale no stricter than the one reported in the table below.
Re-grading policy. You may request a re-evaluation of your work for up to 7 days after the return of your evaluation. Extra credit will not be offered for this course.

93% – 100%	**A**	**4.0**	**73% – 76.9%**	**C**	**2.0**
90% – 92.9%	**A–**	**3.7**	**70% – 72.9%**	**C–**	**1.7**
87% – 89.9%	**B+**	**3.3**	**67% – 69.9%**	**D+**	**1.3**
83% – 86.9%	**B**	**3.0**	**63% – 66.9%**	**D**	**1.0**
80% – 82.9%	**B–**	**2.7**	**60% – 62.9%**	**D–**	**0.7**
77% – 79.9%	**C+**	**2.3**	**0% – 59.9%**	**F**	**0**

Your part – Here are a few points where your full commitment is required:

- → *Note-taking* – Feel free to take plenty of notes, share them with your fellow students, read them/reorganize them before the next class.
- → *Participate* – this includes obvious things, such as trying not to get distracted, taking part in activities according to what you are comfortable with, ask me to slow down or go over it once again if something is not clear.
- → *Ask* me/your fellow students questions – the *rule of the class* is that there is no such thing as a stupid question.
- → Practice, practice, practice! Organic chemistry is learned through a lot of repetition (and mistakes), we will cover numerous examples during our frontal lectures and more examples are included in the handouts with the purpose of giving you more material to practice on. Additionally, the books recommended here represent an extensive collection of examples and problems you may want to review. Suggested readings will be highlighted on a case-by-case basis. If in doubt about a possible solution, do not hesitate to ask for help. In addition, presenting any kind of work is an acquired skill. Practice your presentations. A rule of thumb is that the presentation should be rehearsed multiple times and at least once fully the day before your scheduled time. Fully rehearsing a presentation before class will not help.
- → Use the opportunity of more facetime during student hours!
- → Be ready to challenge yourselves and to critically review your work.

It is my utmost priority to ensure that your learning takes place in a respectful, safe, and constructive environment. I will not tolerate aggressions and any other actions based upon prejudice and intolerance. As a group of people with biases, we shall learn how to understand and work with our differences. Equity and inclusion are critical components for campus community members to thrive and become responsible citizens of the World. If you are a target or a witness of a bias incident, you are encouraged to submit a report to the URI Bias Response Team at www.uri.edu/brt. There you will also find people and resources to help you.

Class Policies

A. Attendance

Attendance is not required; however, I recommend that you attend the majority of class meetings to get the most out of it. You must notify the instructor with sufficient advance if you are unable to attend class. Justifiable absences include illness or injury, religious observances of holy days, grievance, or participation in school-mandated events. It is your sole responsibility to communicate with me prior to the classes. For classes, it is your duty to make up for the missed work. I will be offering you to makeup in-person or virtual lectures during the next available student hours or at a time that suits both of us. **Important!** You **do not need to present a doctor's note**, or a justification letter. It suffices for you to let me know that you won't be coming to class.

B. Class participation

This class is built upon a discussion of topics in organic chemistry. You should participate in the discussion. Questions, comments and rebuttals are more than welcome. Make a rule to say something in each class period. Remember the class rule: there is no such thing as a stupid question*!*

C. COVID-19

As members of the URI community, students and instructors are required to comply with standards of conduct and take precautions to keep themselves and others safe. Visit web.uri.edu/coronavirus/ to keep yourself up to date with the latest guidance about the URI COVID-19 response. **Important**! Do not attend class if you show any symptoms of COVID-19 or related respiratory illness. Instead, you should go get tested. Notify me of your absence before the start of class by email: lorenzo@uri.edu, or phone: (401) 874-2364.

D. Communication with the Instructor

Phone: (401) 874-2364
Email: lorenzo@uri.edu

I expect to get back to you as soon as possible or within 24 hours during weekdays. Emails and messages received after 8:00 pm will be addressed at my earliest convenience or on the next available weekday.

E. Drops and Withdrawals

Missing attendance for the first two class meetings (without notifying me) will result in removal from the class roster. You can drop this class until the third week of classes (02/13/2024). You can withdraw (W on transcript) until 03/04/2024.

F. Academic Honesty and Integrity

You are expected to be honest in all academic work. Your name on any written work or exam shall be regarded as an assurance that the work is the result of your own independent thought, study and effort. You have an obligation to know how to quote, paraphrase, summarize, cite and reference the work of others with integrity. The following are examples (non-comprehensive) of academic dishonesty:

- → Using material, directly of paraphrasing, from published sources without proper citation
- → Claiming disproportionate credit for work not done independently
- → Unauthorized possession or access to exams
- → Unauthorized communication during exams
- → Unauthorized use of another's work or preparing work for another person

- → Taking an exam for another person
- → Altering or trying to alter grades
- → The use of notes/text or electronic devices to gain an unauthorized advantage during exams
- → Fabricating or falsifying facts, data, or references
- → Facilitating or aiding another's academic dishonesty

The university policy on academic honesty is clear. Any incidence of academic dishonesty (see above or URI's Student Handbook), will result in either one or all of the following: a grade of zero, failure of the course, formal notification to the Dean.

G. Electronics and Recording

You may not record any audio and/or video of lectures, student presentations, or student hours *without in-writing permission from all individuals present*. You may choose to take your notes in writing or typing, but your use of electronic devices (laptop, iPad, tablets) should not disrupt the lecture, the instructor, or your colleagues. The use of electronic devices must be limited only to course-specific tasks. Refusal to comply will result in dismissal from the course.

H. Disability Accommodations

Please notify me with your Disability Access and Inclusion (DAI, formerly DSS) accommodation letter as early as possible. I will be happy to discuss and arrange for your approved academic accommodation. If you have not yet established services through DAI, please contact them to engage in a confidential conversation about the process for requesting reasonable accommodations in the classroom. DAI can be reached here: (401) 874-2098, web.uri.edu/disability, https://web.uri.edu/disability/request-form/ email: dai@etal.uri.edu.

I. Student Resources

Your success in this class and as graduate student is very important to me. If you struggle with the course materials or requirements do not hesitate to contact me so that we can discuss possible solutions. Additional resources are available to you as a member of URI Graduate School.

- → The Graduate Writing Center provides writing support to all URI doctoral and master's students to foster continuing development of academic and professional writing skills necessary to succeed in graduate programs and academic or professional careers. Options include 1) one-on-one consultations, 2) writing focused workshops and programs, 3) writing groups, and 4) support for English Language Learners. For more information, visit https://web.uri.edu/graduate-writing-center/. View availability and book an appointment online at https://mywco.com/URIGradWC.
- → Wellness Resource Center (WRC) – provides a relaxing atmosphere and a safe, comfortable space for you to escape the stresses of life. The WRC is located on the lower level of the Anna Fascitelli Fitness and Wellness Center.
- → Campus Recreation offers free membership to their facilities (included in your tuition). Access includes the Fascitelli Fitness and Wellness Center, Mackal indoor courts, cardio and weight rooms, Tootell Aquatic Center, and numerous other facilities and group classes. https://web.uri.edu/campusrec/facilities/
- → *Well-being Coaching* offers one on one meetings with a certified Well-being Coach, who is trained to identify your strengths and support you with a goal or behavior change. Your coach will guide you holistically and support you through day-to-day struggles. https://web.uri.edu/campusrec/well-being-coaching/ or wellcoach@etal.uri.edu

J. Changes to the Syllabus

Due to unforeseen circumstances, the contents of the syllabus and the content of the course may be subject to changes. You will be notified of any change in advance.