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Spring 2021

## CHEM 605-102: Advanced Organic Chemistry, Structure and Mechanism

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## CHEM 605 – Advanced Organic Chemistry, Structure and Mechanism

### *Spring 2021 Course Syllabus*

**NJIT Academic Integrity Code:** All Students should be aware that the Department of Chemistry & Environmental Science (CES) takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

### COURSE INFORMATION

**Course Description:** Structure of organic molecules and mechanisms of organic reactions. Topics include atomic and molecular structure, stereochemistry, reactive intermediates (cations, anions, radicals, and carbenes), orbital symmetry, and spectroscopy. Additional topics include chemical databases, as well as reading and writing organic chemistry articles.

**Number of Credits:** 3

**Prerequisites:** Undergraduate organic chemistry. Students that are not fully comfortable with the material of undergraduate organic chemistry will need to revisit it on their own in order to do well in this class.

**Instructor:** Dr. Pier Alexandre Champagne  
Office: Tiernan Hall (TIER) 354  
Email: pier.a.champagne@njit.edu

**Lectures:** Thursdays, 6:00-9:00 PM  
Synchronous online using Webex (link found in Canvas page)

**Office Hours:** Wednesdays, 4:30 – 6:30 PM  
Mondays, 4:30 – 6:30 PM  
Office hours will occur on Webex. If you are unable to make these schedules times, send an email to schedule an appointment. We can also meet face-to-face by appointment.

**Textbooks:** Material for this class will come from two main textbooks. None are required but they are recommended. Students are also encouraged to purchase a molecular model kit, which will also be allowed during the exams.

<b>Title</b>	Intermediate Organic Chemistry	Advanced Organic Chemistry, Part A: Structure and Mechanisms
<b>Authors</b>	Ann M. Fabirkiewicz, John C. Stowell	Francis A. Carey, Richard J. Sundberg
<b>Edition</b>	3 <sup>rd</sup> edition	5 <sup>th</sup> edition
<b>Publisher</b>	Wiley	Springer
<b>ISBN #</b>	978-1-118-30881-3	978-0387448978

## LEARNING OUTCOMES

After completing this course, students will be able to:

- Find information on compounds, reactions and authors in the chemical databases;
- Identify the key scientific journals in the field of organic chemistry and use their websites;
- Actively read and critique research articles by identifying important features, learning about precedents and analyzing the data presented.
- Discuss research results in a scientific report and presentation;
- Relate the molecular structure to orbital arrangement, stability and reactivity;
- Distinguish between the various types of stereoisomers and conformations;
- Propose experimental and computational techniques for the study of specific reaction mechanisms
- Propose plausible reaction mechanisms based on experimental data, using the curved-arrow formalism.
- Use molecular orbital theory to describe sigma and pi bonds, conjugated, or aromatic systems
- Describe the mechanisms of reactions happening to aromatic systems;
- Describe the mechanisms of substitution reactions such as the S<sub>N</sub>1 and S<sub>N</sub>2 reactions;
- Estimate the stability and reactivity of various cationic, anionic and radical intermediates;
- Describe the mechanisms of addition and elimination reactions;
- Use carbon nucleophiles for the synthesis of C–C bonds;
- Describe the mechanisms involved in the addition or substitution reactions of carbonyl compounds;
- Identify free-radical reactions and explain the various steps in their mechanisms.

## POLICIES

All CES students must familiarize themselves with, and adhere to, all official university-wide student policies. CES takes these policies very seriously and enforces them strictly.

**Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: <http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf>.**

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. **Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.** If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at [dos@njit.edu](mailto:dos@njit.edu)

**Grading Policy:** The final grade in this course will be determined as follows:

Weekly forum participation	10%
Literature assignment and presentation	25%
Biweekly problem sets	50%
Final Exam	20%

Your final letter grade in this course will be based on the following tentative curve:

A	100-90%	C	74-70%
B+	89-85%	D	69-65%
B	84-80%	F	Below 65%
C+	79-75%		

**Participation:** As this is a graduate course, class participation is expected. Students are expected to join class on time. Students are also expected to arrive prepared through reading on the material before the lecture, and to ask and answer questions during class.

**Weekly forum participation:** Each week, the instructor will post a discussion topic regarding the course material on the Canvas page. Each student is expected to **1)** post in that discussion and **2)** Interact with the other students' posts by answering their questions and/or making constructive comments. The instructor will assess the thoughtfulness and effort deployed by each student to determine their grade.

Questions about the course material or assignments should be posted on the forum as well, so that all students can benefit from the answers.

**Literature assignment and presentation:** Reading research papers and presenting results are key skills in organic chemistry. During the semester, students will be asked to discuss about two organic chemistry papers of their choosing that were published in 2020 or 2021. A written report on the first paper, due halfway through the semester, will be worth 10 points. A 15-minute presentation on the second paper, done during the last lecture of the semester, will be worth 15 points. Detailed assignment information will be provided during the semester.

**Problem sets:** A total of seven (7) problem sets will be assigned during the semester, one every two weeks. Submission of the problem sets will happen electronically on Canvas, combined with a short quiz to ensure that each student worked on their own problem sets. Students must turn in their own answers to the problems, properly scanned or prepared using an appropriate software. Students are responsible for the legibility of the work they turn in. The quiz part of the problem set will be worth 10% of the grade, and overall the 7 problem sets will be worth a total of 50 points.

**Exam:** There will be a single, comprehensive, final exam. The exam will cover chapters 3-9. The exam will be given online through Canvas, using the Lockdown Browser system. This exam will happen during the final exam week (May 7<sup>th</sup> – 13<sup>th</sup>), most likely on Thursday, May 13<sup>th</sup>.

**Attendance Policy:** The link to the Webex room will always be found on the Canvas page of the course. Except when Powerpoint slides will be used, the notes will not be provided. If the students don't attend the lectures, they will not have access to the material. Exceptions can be made if the absence is excused by the Dean of Students.

**Email Policy:** All email communication should be done using the "njit.edu" domain. No chemistry questions will be answered through email. Office hours or the Canvas forum should be used for questions.

**Make-up Exam Policy:** There will be **no make-up exams** during the semester. In the event that a student has a legitimate reason for missing an exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the CES Department Office/Instructor that the exam will be missed so that appropriate steps can be taken to make up the grade.

## ADDITIONAL RESOURCES

**Chemistry Tutoring Center:** Located in the Central King Building, Lower Level, Rm. G12. Hours of operation are Monday - Friday 10:00 am - 6:00 pm. For further information please click [here](#).

**Accommodation of Disabilities:** Office of Accessibility Resources and Services (*formerly known as Disability Support Services*) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please contact Chantonette Lyles, Associate Director at the Office of Accessibility Resources and Services at 973-596-5417 or via email at [lyles@njit.edu](mailto:lyles@njit.edu). The office

is located in Fenster Hall Room 260. A Letter of Accommodation Eligibility from the Office of Accessibility Resources Services office authorizing your accommodations will be required.

For further information regarding self-identification, the submission of medical documentation and additional support services provided please visit the Accessibility Resources and Services (OARS) website at:

- <http://www5.njit.edu/studentsuccess/disability-support-services/>

**Important Dates:**

See: Spring 2021 Academic Calendar, Registrar <https://www5.njit.edu/registrar/spring-2021-academic-calendar/>

Date	Day	Event
January 18	M	Martin Luther King, Jr. Day
January 19	T	First Day of Classes
January 23	Sa	Saturday Classes Begin
January 25	M	Last Day to Add/Drop a Class
January 25	M	Last Day for 100% Refund, Full or Partial Withdrawal
January 26	T	W Grades Posted for Course Withdrawals
February 2	T	Last Day for 90% Refund, Full or Partial Withdrawal - No Refund for Partial Withdrawal after this date
February 15	M	Last Day for 50% Refund, Full Withdrawal
March 8	M	Last Day for 25% Refund, Full Withdrawal
March 14	Su	Spring Recess Begins - No Classes Scheduled - University Open
March 21	Su	Spring Recess Ends
April 2	F	Good Friday - No Classes Scheduled - University Closed
April 5	M	Last Day to Withdraw
May 4	T	Friday Classes Meet
May 4	T	Last Day of Classes
May 5	W	Reading Day 1
May 6	R	Reading Day 2
May 7	F	Final Exams Begin
May 13	R	Final Exams End

# COURSE OUTLINE

Date	Topic	Pre-lecture reading	Assignments and due dates
Jan. 21 <sup>th</sup>	Syllabus Organic chemistry general review Chapter 1: Chemical Databases	IOC Chap. 2	
Jan. 28 <sup>th</sup>	Chapter 2: Reading and Writing Research Articles	Provided research article	
Feb. 4 <sup>th</sup>	Chapter 3: Stereochemistry	IOC Chap. 3	Problem set #1 due
Feb. 11 <sup>th</sup>	Chapter 4: Study and description of organic reaction mechanisms	IOC Chap. 4	
Feb. 18 <sup>th</sup>	Chapter 4: Study and description of organic reaction mechanisms		Problem set #2 due
Feb. 25 <sup>th</sup>	Chapter 5: Conjugation, aromaticity and pericyclic reactions	IOC Chap. 5	
Mar. 4 <sup>th</sup>	Chapter 5: Conjugation, aromaticity and pericyclic reactions		Problem set #3 due
Mar. 11 <sup>th</sup>	Chapter 6: Nucleophilic substitution	AOC Chap. 4	Literature report due
Mar. 18 <sup>th</sup>	Spring recess (no class)		
Mar. 25 <sup>th</sup>	Chapter 6: Nucleophilic substitution		Problem set #4 due
Apr. 1 <sup>st</sup>	Chapter 7: Polar addition and elimination reactions	AOC Chap. 5	
Apr. 8 <sup>th</sup>	Chapter 8: Carbanions and carbon nucleophiles	AOC Chap. 6	Problem set #5 due
Apr. 15 <sup>th</sup>	Chapter 9: Addition and substitution reactions on carbonyl compounds:	AOC Chap. 7	
Apr. 22 <sup>nd</sup>	Chapter 9: Addition and substitution reactions on carbonyl compounds:		Problem set #6 due
Apr. 29 <sup>th</sup>	Literature presentations		Literature presentations
May 6 <sup>th</sup> (reading day)	Review		Problem set #7 due
May 13 <sup>th</sup>	Final exam (tentative date)		Final exam

IOC: Intermediate Organic Chemistry, by Fabirkiewicz and Stowell  
 AOC: Advanced Organic Chemistry, by Carey and Sundberg

*Updated by Genti' Price - August, 2020  
 Department of Chemistry & Environmental Sciences (CES)  
 Course Syllabus, Spring 2021*