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CHEM 245-001: Organic Chemistry for Chemical Engineers

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Chemistry 245 Organic Chemistry for Chemical Engineers *Spring 2021 Course Syllabus*

The shift to remote and converged teaching due to the COVID-19 pandemic has required that both instructors and students make changes to their normal working protocols for courses. Students are asked to practice extra care and attention in regard to academic honesty, with the understanding that all cases of plagiarism, cheating, multiple submission, and unauthorized collaboration are subject to penalty. Students must properly cite and attribute all sources used for papers and assignments. Students may not collaborate on exams or assignments, directly or through virtual consultation, unless the instructor gives specific permission to do so. Posting an exam, assignment, or answers to them on an online forum (before, during, or after the due date), in addition to consulting posted materials, constitutes a violation of the university's Honesty policy. Likewise, unauthorized use of live assistance websites, including seeking "expert" help for specific questions during an exam, can be construed as a violation of the honesty policy.

All students should be familiar with the [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.

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

COURSE INFORMATION

Course Description: This one semester course encompasses a treatment of all the main concepts in a traditional two semester Organic Chemistry Course. After a theoretical treatment of the structure and stereochemistry of organic molecules, the course goes deeply into an introduction of the major classes of organic molecules and their reactivity with special emphasis on the most common chemical reactions found in the chemical processing industry. A brief treatment of the major spectroscopic methods for structure elucidation completes the course.

Number of Credits: 4

Prerequisites: Undergraduate level CHEM 126 Minimum Grade of C or Undergraduate level CHEM 126 Minimum Grade of T or Undergraduate level CHEM 122 Minimum Grade of T or Undergraduate level CHEM 122 Minimum Grade of C

Course-Section and Instructors

Course-Section	Instructor
CHEM 245-001	Dr. Christopher DeSantis
Webex URL	https://njit.webex.com/meet/cdesantinjit.edu

Email: christopher.a.desantis@njit.edu

Office: Tiernan Hall B006 (basement)

Class Schedule

Tuesday	8:30 am – 9:50 am	KUPF 108
Tuesday	4:00 pm – 5:55 pm	KUPF 204
Thursday	8:30 am – 9:50 am	KUPF 108

Office Hours: IN WEBEX ROOM: <https://njit.webex.com/meet/cdesantinjit.edu>

Also available by appointment. In-Person meetings available by appointment only.

Webpage: The course website is available through Canvas, which can be accessed via the njit.edu. Please email me immediately if you cannot access the class site. All materials including lecture summaries, any PowerPoint slides, and other documents will be posted on the class site. Please check the site frequently for new materials and announcements. All grades for this course will be posted to Canvas on a regular basis. You are responsible for all updates posted to Canvas, and if you find any mistakes in content or grading, or you need help accessing these materials, please contact your instructor as soon as possible.

Required items: A laptop with access to canvas and webex, Respondus Browser, and the textbook.

Title	Organic Chemistry
Author	Wade and Simek
Edition	9th
Publisher	Pearson, Glenview, IL
ISBN #	ISBN-13: 978-0321971371

University-wide Withdrawal Date: The last day to withdraw with a **W** is November 10th, 2021. It will be strictly enforced.

Learning Outcomes: Upon completing *Chemistry 245, Organic Chemistry for Chemical Engineers*, the student will be able to do the following:

I. Basics

1. Draw chemical structures (condensed structures, structural formulas and line-angle formulas) for organic compounds including exceptions to the octet rule
2. Use VSEPR and concepts of hybridization to predict and explain the geometry of molecules
3. Discuss electronegativity and bond polarity
4. Discuss nucleophilicity and electrophilicity, and predict nucleophilic or electrophilic sites based on the structure of molecules
5. Discuss resonance and delocalization of charge in molecules
6. Identify various functional groups in organic molecules, particularly alkenes, alkynes, alcohols, acids, ethers, esters, aldehydes, ketones and amines
7. Explain Lewis acid-base theory
8. Explain rules of nomenclature to describe the various hydrocarbons
9. Describe structural and geometric isomerism
10. Describe types of intermolecular forces and explain how molecular polarity affects intermolecular forces
11. Explain the role of kinetics and thermodynamics for chemical synthesis; use potential energy diagrams

II. Structures and Reactions

12. Draw curved arrows and explain reaction mechanisms
13. Identify and describe the reactivity of various intermediates (cations, anions and radicals) produced during reactions of hydrocarbons (and other organic transformations)
14. Describe chirality and distinguish between R and S stereoisomers
15. Discuss and draw the products of substitution and elimination reactions of alkyl electrophiles
16. Describe substitution reactions and recognize SN1, SN2, E1 and E2 reactions
17. Determine the major products formed during elimination and substitution reactions (Markovnikov's rule, Zaitsev's rule)
18. Describe the properties, synthesis, and reactivity of alcohols
19. Describe the properties, synthesis and reactivity of ethers, cyclic ethers, thioethers and epoxides
20. Explain the properties and reactivity of various conjugated systems

21. Use Hückel's rule to determine if compounds are aromatic, anti-aromatic or non-aromatic, and predict chemical reactions involving aromatic compounds
22. Predict the products of reactions involving or forming ketones and aldehydes, amines, carboxylic acids and derivatives.
23. Devise syntheses of complex molecules from simpler reactants by using retrosynthetic analysis.
24. Recognize the role of organic reactions in chemical engineering, such as the synthesis of materials, polymers and/or fine chemicals

III. Structures and Analysis

25. Explain the electromagnetic spectrum and the use of spectral regions to determine molecular structure
26. Explain the use of IR spectroscopy to determine functional groups
27. Explain the role of mass spectrometry in determining the molecular formula of a compound, and identify isotopes
28. Discuss Nuclear Magnetic Resonance Spectroscopy (NMR) including ^1H and ^{13}C , and apply NMR to determine the structure of organic compounds
29. Explain UV spectroscopy and describe the use of UV absorption in structural determination of conjugated systems
30. Synthesize spectral information from the different techniques to solve for the structure of an unknown compound

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.

In addition, obtaining course materials such as past exams or solutions to homework and/or class assignments from external sources constitutes cheating. The official Student's Solutions Guide is exempt. Posting of course materials on external websites without the approval of the instructor violates intellectual property laws and hence strictly forbidden. Any student caught cheating on an assignment will be assessed a penalty of 20 points, in addition to a grade of zero for the given assignment.

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

In Class Worksheets (13x)	130
Participation – 3 things (26x) + In Class Polling (26x)	104
Homework (13x + review)	75
Synthesis Challenge	50
Pre-Chapter Assignment (15x)	45
Quizzes (4x)	100
Exam I	100
Exam II	100
Exam III	100
Exam IV	125
Total Points	929

A	771 > pts.	C	510 ≥ pts.
B+	720 ≥ pts.	D	464 ≥ pts.
B	650 ≥ pts.	F	464 < pts.
C+	580 ≥ pts.		

You must maintain an average of 35%, which is 183 points, in the exam and quizzes to be considered for a grade of D or higher. You will receive an F even if you have adequate point total without this requirement.

Participation: Attendance at classes is **highly recommended**. Each class is a learning experience that cannot be replicated through simply "getting the notes." This is also a highly compacted course and even one absence may cause a steep drop in course performance. Absences for unavoidable legitimate reasons will be permitted upon presentation of appropriate

supporting documentation to the Dean of Students. During lectures, students will be tasked with answering polled questions. Students must answer at least ½ of the questions presented to earn participation credit. Poll participation will be worth 44 points of the total grade. At the end of each lectures, students will be required to complete a “3 things” short answer survey which will be worth 2 pts each in Canvas (44 pts total). **“3 things” survey must be completed by 11:59PM on the same day as lecture.**

In Class Worksheets: There will be 13 in class works sheets worth 10 points each. Students will work in groups to develop solutions to the problems but each student must hand in a copy of their own work. The purpose of the group work is to teach each other topics in class and to discuss problems presented in the course. It is not intended for students to copy work from other students once a solution is presented. If you formulate a solution before your teammates, become the teacher! This will reinforce your own understanding. Worksheets will be graded for each individual student. **Worksheets which are not completed in class may be completed up to 7 days after they have been presented to the class.** Missed worksheets due to approved absences may be completed after their due date. Late assignments will not be accepted. Each student will upload their own work in Canvas. **Every student is expected to equally contribute to the work.** Each student will earn the grade for their own work.

Synthetic Challenges: At the end of the semester, students will be divided into groups of 2 or 3. Groups will be presented with a synthetic target, starting material, and starting material restrictions and be tasked with generating an original synthetic scheme to create the target molecule. Presentations will be made and accompanied by a formal document explaining their synthesis. During their presentation, they must provide a short presentation and include any references for reactions they find in scientific literature. They must present their synthesis to the class and explain what each reaction accomplishes and propose a mechanism for all reactions they incorporate in their synthesis. The score will be based on two components: the synthetic scheme and presentation. Synthetic schemes will be judged on brevity of synthetic route, selectivity, and likelihood of success of the synthesis. The presentation will be judged on knowledge of synthetic scheme, presentation quality, and mechanism presentations. A formal rubric will provide at a later date.

Pre-Chapter Assignments: A short assignment in Canvas worth 3 points will be due before the beginning of each chapter. The purpose of the short assignment is to allow students to become familiar with basic topics to be covered in the lecture. Pre-chapter Assignments will be due at the beginning of lecture and will not be accepted late.

Homework Policy: 13 homework assignments worth 5 points and 1 review worth 10 points will be presented. On time homework completion is critical to success in this course. The homework due dates will be clearly posted in Canvas and discussed in class. Plan timely homework completion accordingly. Late homework will not be accepted without a valid excuse and appropriate documentation. Each student is responsible for turning in an electronic copy of their own work. Homework will be accepted until 11:59PM on the day they are due in Canvas. The homework will be released as a PDF and students will submit a picture or scan of their work on Canvas in the assignment.

Quizzes: Quizzes are given according to the tentative date shown on the course calendar below. There will be four quizzes given at the end of lecture worth 25 pts each. Their course content coverage will be announced in lecture. Use of notes, notebooks, or textbooks will not be permitted and mobile communication devices (iPhones, mobile phones, PDAs, computers, netbooks, smart watches etc.) should remain turned off and stored in your bag for the duration of the exam period. Students are permitted to use molecular modeling kits during quizzes. Violations of this policy will be submitted to the Office of the Dean of Students for review. **Each student is required to bring a photo ID to a quiz and this will be used to confirm a student’s identity during the quiz period. Quizzes will be administered in the Respondus Lockdown Browser and proctored live in class. Quizzes will take place as scheduled and a sterile test taking environment is expected for each student. Quizzes will be timed and take place as shown on the class calendar.**

Exams: There will be 4 exams total in the semester held during class time during the semester. The following exam periods and course coverage are tentative and therefore subject to change:

Exam I (Ch. 1-4)	September 30 th
Exam II (Ch. 5-8)	October 28 th

Exam III (Ch. 9-13)	November 23 rd
Final Exam (Ch 13-20)	TBA (During finals week)

The final exam will not be cumulative. Use of notes, notebooks, or textbooks will not be permitted and mobile communication devices (iPhones, mobile phones, PDAs, computers, netbooks, smart watches etc.) should remain turned off and stored in your bag for the duration of the exam period. Students are permitted to use molecular modeling kits during exams. Violations of this policy will be submitted to the Office of the Dean of Students for review. **Each student is required to bring a photo ID to an exam and this will be used to confirm a student's identity during the exam period.** Exams will be returned to students as soon as possible. **Exam regrades must be submitted within 1 week of returning the exam with a sheet describing the error.** Exams will be administered in the Respondus Lockdown Browser and proctored live in class. **Exams will take place as scheduled and a sterile test taking environment is expected for each student. The exam will have two portions, both will be completed with the Respondus Lockdown Browser. The first portion will be made up of multiple choice, true and false, fill in the blank and other types of short answer questions and will be graded in Canvas. The second portion will be an open ended answer portion. The open ended questions will be presented with the multiple choice questions and completed with the lockdown browser enabled. After closing the lockdown browser, students will have 10 minutes to upload an image in the accompanying assignment of the exam. The assignment will not have the questions but just serve as a place to submit the open ended questions. Time stamps recorded by Respondus and Canvas will be used to verify the 10 minute window to upload open ended answers.**

In the event of online class mode being adopted due to COVID surge, the exams will be administered in the using the RESPONDUS browser with Webcam and be live proctored in a Webex meeting. **This browser is available in Canvas. Students must complete a proper environment check before starting the exam in the exam video by showing their calculator, blank scratch paper, their work surface, cell phone is placed away from work area, and a 360 degree view of their workspace to confirm no information is posted around the work area. Students may only use scientific (non-programmable, non-graphing) calculators on exams. The student will also be asked to show a photo-ID.**

During the exam from home (if needed), you have to adopt the following behaviors

1. No cell phones anywhere near the exam-- any indication of cell phone presence (a ring tone, vibration, music, will result in a point penalty)
2. No Talking to family members.
3. No Covering of face (either with clothing or hand) except for mask.
4. No Moving out of frame.
5. No Listening to music.
6. Setting up the camera so that the camera's view is not completely on student and workspace.

To protect the test's integrity, anyone found to violate any of the rules (2-6) of an exam will be docked 20 points for each violation from their exam score.

We understand these are difficult times and it is natural to move around when taking an exam in the comfort of your home. We must remind you that this is a high stakes exam and must be treated as such. Please observe all exam rules as if you were taking the exam in person.

Makeup Exam/Quiz Policy: There will normally be **NO MAKE-UP QUIZZES OR EXAMS** during the semester unless a valid excuse is provided to the Dean of Students. In the event that a student has a legitimate reason for missing a quiz or 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.

GRADING ERROR: Assignments are returned through Canvas. If you believe there is an error, you have until one week following return of the assignment to submit a piece of work for regrading. You must write a very brief description of the problem on the back of the test.

Cellular Phones/Smart Watches: All cellular phones and other electronic devices must be switched off during all class times unless they are being used to participate in class. Such devices must be stowed in bags during exams or quizzes. Students are not permitted to keep cell phones on their person during any exams. If a cell phone is discovered in your possession during an exam the exam will be removed and immediately graded a 0.

Textbook Problems: It is important to study outside this course in order to achieve the best results. The problems within the text

book, both in chapter and at the end of the chapter, provide excellent practice for the course material. Work out the problems without the study guide and check your answers after completion to ensure optimal understanding of the material. **Students are not responsible for questions related to sections not covered in the class.**

How to be successful in organic chemistry: Organic chemistry is a difficult subject and it is vital to master new material as it is presented. A successful student will 1) prepare ahead of class by reading the chapter to be discussed, completing the pre-class assignment, and formulating questions to ask in lecture 2) attend and participate in lecture by answering and asking questions and 3) work after lecture on homework and book problems. Homework is a vital part of mastering organic chemistry and nothing can replace practice. There are numerous resources for practice including online resources, the tutoring center, office hours, library resources, and other organic textbooks/workbooks. Work on problems without the solution manual open and then check answers afterwards. **Feel free to email me or come visit during office hours with any questions you may have!** After an exam/quiz/homework assignment is returned, correct any lapses in knowledge by working on topics that may have been answered incorrectly. Mastering organic chemistry takes time and practice so set aside committed time slots in your schedule to work on organic chemistry. Finally, always ask the “why” question when doing homework rather than simply memorizing answers.

Academic Integrity: *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

ADDITIONAL RESOURCES

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. 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/>

Using Respondus LockDown Browser and a Webcam for Online Exams

Respondus LockDown Browser is a locked browser for taking assessments or quizzes in Canvas or Moodle. It prevents you from printing, copying, going to another URL, or accessing other applications during a quiz. If a Canvas or Moodle quiz requires that LockDown Browser be used, you will not be able to take the assessment or quiz with a standard web browser. You may be required to use LockDown Browser with a webcam (Respondus Monitor), which will record you during an online exam.

The webcam can be built into your computer or can be the type that plugs in with a USB cable. Watch this [short video](#) to get a basic understanding of LockDown Browser and the webcam feature. A student [Quick Start Guide \(PDF\)](#) is also available.

1. Download and install LockDown Browser from this link:
<http://www.respondus.com/lockdown/download.php?id=264548414>
2. Once your download has finished, locate the “LockDown Browser” shortcut on the desktop and double-click it. (For Mac users, launch “LockDown Browser” from the Applications folder.)
3. You will be brought to the Canvas or Moodle login page within the LockDown Browser. If you are in Moodle, click “Login with your UCID” to log in with your NJIT UCID and password and then click Login.
4. Under “My courses,” click on the course in which you have to take the exam that requires the LockDown Browser.

5. After you enter the course, find the exam and click on it.
6. A confirmation prompt will appear. Click the "Start attempt" button. Once a quiz has been started with LockDown Browser, you cannot exit until the Submit all and finish button is clicked.
7. If you are required to use a webcam (Respondus Monitor), you will be prompted to complete a Webcam Check and other Startup Sequence steps.

IST Service Desk

Students may contact the IST Service Desk with any questions. Questions or problems can be submitted via web form by going to: <https://servicedesk.njit.edu> and clicking on the "Report your issue online" link.

You may also call the IST Service Desk with any questions at 973-596-2900.

Important Dates

September	1	First Day of Classes
September	4	Saturday Classes Begin
September	6	Labor Day
September	8	Monday Classes Meet
September	8	Last Day to Add/Drop a Class
September	8	Last Day for 100% Refund, Full or Partial Withdrawal
September	9	W Grades Posted for Course Withdrawals
September	15	Last Day for 90% Refund, Full or Partial Withdrawal - No Refund for Partial Withdrawal after this date
September	29	Last Day for 50% Refund, Full Withdrawal
October	20	Last Day for 25% Refund, Full Withdrawal
November	10	Last Day to Withdraw from Classes
November	25	Thanksgiving Recess Begins
November	28	Thanksgiving Recess Ends
December	10	Last Day of Classes
December	11	Saturday Classes Meet
December	12	Sunday Classes Meet
December	13	Reading Day 1

December	14	Reading Day 2
December	15	Final Exams Begin
December	21	Final Exams End
December	23	Final Grades Due

Course Outline

Week	Monday	Tuesday	Wednesday	Thursday	Friday
1	8/30	8/31	9/1	9/2 Lecture 1 – Ch. 1 Class Introductions	9/3
2	9/6 No Classes	9/7 Lecture 2 – Ch. 1 Chem 125/126 Review Due Worksheet 1	9/8	9/9 Lecture 3 – Ch. 1/2 Homework 1 Due	9/10
3	9/13	9/14 Lecture 4 – Ch. 2 Worksheet 2	9/15	9/16 Lecture 5 – Ch. 3 Homework 2 Due	9/17
4	9/20	9/21 Lecture 6 – Ch. 3/4 Worksheet 3 Quiz 1	9/22	9/23 Lecture 7 – 4 Homework 3 Due	9/24
5	9/27	9/28 Lecture 8 – Ch. 5 Worksheet 4	9/29	9/30 Exam 1 Homework 4 Due	10/1
6	10/4	10/5 Lecture 9 – Ch. 5/6 Worksheet 5	10/6	10/7 Lecture 10 – Ch. 6 Homework 5 Due	10/8
7	10/11	10/12 Lecture 11 – Ch. 7 Worksheet 6	10/13	10/14 Lecture 12 – Ch. 7/8 Homework 6 Due	10/15
8	10/18	10/19 Lecture 13 – Ch. 8 Worksheet 7 Quiz 2	10/20	10/21 Lecture 14 – Ch. 9 Homework 7 Due	10/22

9	10/25	10/26 Lecture 15 – Ch. 9/10 Worksheet 8	10/27	10/28 Exam 2 Homework 8 Due	10/29
10	11/1	11/2 Lecture 16 – Ch. 10 Worksheet 9	11/3	11/4 Lecture 17 – Ch. 11 Homework 9 Due	11/5
11	11/8	11/9 Lecture 18 – Ch. 12 Worksheet 10	11/10	11/11 Lecture 19 – Chp 12 Homework 10 Due	11/12
12	11/15	11/16 Lecture 20– Ch. 13 Worksheet 11 Quiz 3	11/17	11/18 Lecture 21 - Ch. 14 Homework 11 Due	11/19
13	11/22	11/23 Lecture 22 – Ch. 14 Exam 3	11/24	11/25 Thanksgiving Recess No class	11/26 Thanksgiving Recess No class
14	11/29	11/30 Lecture 23 – Ch. 16/17 Worksheet 12	12/1	12/2 Lecture 24 – Ch. 16/17 Homework 12 Due	12/3
15	12/6	12/7 Lecture 25 – Ch. 18/20 Worksheet 13 Quiz 4	12/8	12/9 Lecture 26 – Ch. 18/20 Homework 13 Due Synthetic Challenges Presentations	12/10 Last Day of Classes
16	12/13 Reading Day 1	12/14 Reading Day 2	12/15 Finals Begin	12/16	12/17
17	12/20	12/21 Finals End	12/22	12/23 Final Grades Due	

*Updated by Dr. DeSantis August 2021
Department of Chemistry & Environmental Sciences
Course Syllabus, Fall 2021*
