

# Organic Spectroscopy

## Chem 395/425 – Spring 2023

**Catalog Description:** The objective of this course is to provide an overview of methods employed in organic structure elucidation. Techniques will primarily include ultraviolet-visible spectroscopy, infrared spectroscopy, mass spectrometry, and nuclear magnetic resonance spectroscopy.

**Instructor:** Prof. Kelvin Billingsley  
**Office:** FH-209  
**Email:** kbillingsley@luc.edu

**Course:** Chem 395/425 Section 01  
**Course Schedule:** MW 6-7:15 PM  
**Prerequisites:** Chem 221/222, Chem 223/224 or graduate standing  
**Office Hours:** M 3:30-4:30 PM or by appointment  
**Course website:** Sakai (problem sets, reading, notes, and announcements)  
**Textbook:** Organic Structure Analysis, 2<sup>nd</sup> Ed. Oxford University Press: New York, 2010.  
**Model Kit:** An organic molecular model kit is optional but recommended

**Grading Policy:** Problem Sets (100) + Midterm (100) + Final (100) = 300 total points  
**Grading Scale:** A: 94, A-: 90, B+: 86, B: 82, B-: 78, C+: 74, C: 70, C-: 65, D+: 60, D: 55, F: 50

**Problem Sets:** There will be four problems sets throughout the semester. Each problem set is worth 25 points. A tentative schedule of due dates is available on the course website.

**Exams:** The Midterm (100 points, Mar 1<sup>st</sup>) and Final (100 points, May 1<sup>st</sup>) will be conducted in a “take-home” format. Student collaboration on answers is prohibited. Instructions will be provided in advance of the exam date.

**Late Assignments:** Any assignment submitted after the cutoff time should be emailed directly to Prof. Billingsley. An initial 25% penalty of the maximum assignment point total will be enforced for any late assignment received after the cutoff time. An additional 1.5% penalty will be enforced every hour until the completed assignment is received.

**Academic Integrity:** All students in this course are expected to have read and to abide by the demanding standard of personal honesty, drafted by the College of Arts & Sciences, which can be viewed at: <https://www.luc.edu/cas/advising/academicintegritystatement/> A basic mission of a university is to search for and to communicate the truth as it is honestly perceived. A genuine learning community cannot exist unless this demanding standard is a fundamental tenet of the intellectual life of the community. Students at Loyola University Chicago are expected to know, to respect, and to practice this standard of personal honesty. Academic dishonesty can take several forms, including, but not limited to cheating, plagiarism, copying another student’s work, submitting false documents, and deliberately disrupting the performance of other class members. All work submitted for evaluation must be the student’s own work. *Zero credit will be given to all students involved in cheating on exams or problem sets, and any instance of dishonesty will be reported to the department chair who will decide on any further steps.*

### Course Outline:

#### Part 1. Standard Analytical Techniques

- A. Chemical analysis
- B. UV-Vis spectroscopy
- C. Infrared spectroscopy
- D. Mass spectrometry

#### Part 2. Nuclear Magnetic Resonance Spectroscopy

- A. <sup>1</sup>H NMR: theory and concepts
- B. Spin-spin coupling
- C. <sup>13</sup>C NMR and other non-<sup>1</sup>H nuclei
- D. Multi-pulse and -dimensional NMR techniques

## Other Administrative Items

Academic Calendar: [www.luc.edu/academics/schedules](http://www.luc.edu/academics/schedules)

Universal Absence Accommodation Policy: The purpose of a universal absence accommodation policy is to account for emergency circumstances (e.g., serious illness, caring for a family member, car accident) that require you to be absent from class, while maintaining fairness in grading for students who attend and complete all in-class graded assignments. We believe that class attendance and participation are essential for your success in this class, and that your health is important to us and our shared community. Please use good judgement and stay home if necessary/prudent for your circumstances. You may provide documentation for an absence, but it is not required. These accommodations are automatically available to all students. Regular attendance will not be taken in this course. *If a student must be absent on a day when an assignment is due, then they must arrange an earlier time (prior to the due date) to turn in the assignment. Otherwise, the assignment will be subject to the “Late Assignments” policy outlined in this syllabus.*

Student Accommodations: Loyola University provides reasonable accommodations for students with disabilities. Any student requesting accommodations related to a disability or other condition is required to register with Student Accessibility Center (SAC), located in Sullivan Center, Suite 117. Professors receive the accommodation notification from SAC via Accommodate. Students are encouraged to meet with their professor individually in order to discuss their accommodations. All information will remain confidential. Please note that in this class, software may be used to record class lectures in order to provide equal access to students with disabilities. Students approved for this accommodation use recordings for their personal study only and recordings may not be shared with other people or used in any way against the faculty member, other lecturers, or students whose classroom comments are recorded as part of the class activity. Recordings are deleted at the end of the semester. For more information about registering with SAC or questions about accommodations, please contact SAC at 773-508-3700 or [SAC@luc.edu](mailto:SAC@luc.edu).

Loyola University Absence Policy for Students in Co-Curricular: Students missing classes while representing Loyola University Chicago in an official capacity (e.g., intercollegiate athletics, debate team, model government organization) shall be allowed by the faculty member of record to make up any assignments and to receive notes or other written information distributed in the missed classes. Students should discuss with faculty the potential consequences of missing lectures and the ways in which they can be remedied. Students must provide their instructors with proper documentation i.e., “Athletic Competition & Travel Letter” describing the reason for and date of the absence. This documentation must be signed by an appropriate faculty or staff member and it must be provided to the professor in the first week of a semester. It is the responsibility of the student to make up any assignments. If the student misses an examination, the instructor is required to allow the student to take the examination at another time. (<https://www.luc.edu/athleteadvising/attendance.shtml>) Students who will miss class for an academic competition or conference must provide proper documentation to their instructor as early in the semester as possible.

Accommodations for Religious Reasons: If you have observances of religious holidays that will cause you to miss class or otherwise effect your performance in the class you must alert the instructor within 10 calendar days of the first class meeting of the semester to request special accommodations, which will be handled on a case by case basis.

Further Information about Final Exam Policies: The University sets the schedule for all final exams. Additional time will not be granted, even if you start late. There will be no make-up final exams given under any circumstance, and the exam will not be given early, either. Instructors may not reschedule final exams for a class for another day and/or time during the final exam period. There can be no divergence from the posted schedule of dates for final exams. Individual students who have four (4) final examinations scheduled for the same date may request to have one of those exams rescheduled. If a student reports having four final examinations scheduled for the same date, students should be directed to e-mail a petition to Adam Patricoski, Assistant Dean for Student

Academic Affairs, CAS Dean's Office (apatricoski@luc.edu).

Course Repeat Rule: Effective with the Fall 2017 semester, students are allowed only THREE attempts to pass Chemistry courses with a C- or better grade. The three attempts include withdrawals (W). The Department advises that it is preferable to complete a course with a grade of C or C-, and to demonstrate growth in future coursework, than to withdraw from a course. After the second attempt, the student must secure approval for a third attempt. Students must come to the Chemistry Department, fill out a permission to register form or print it from the Department of Chemistry & Biochemistry website: <https://www.luc.edu/chemistry/forms/> and personally meet and obtain a signature from either the Undergraduate Program Director, Assistant Chairperson, or Chairperson in Chemistry. A copy of this form is then taken to your Academic Advisor in Sullivan to secure final permission for the attempt.

Copyright: Following university policies, materials from the course cannot be shared outside the course without the instructor's written permission.