COURSE OVERVIEW
Welcome to Organic Chemistry! The purpose of this laboratory course is to introduce students to the techniques that organic chemists (as well as biochemists, physical chemists, etc.) use in their daily routines. After learning and understanding those techniques, students will apply their knowledge to new situations to understand synthesis reactions, molecular structure determination, and analysis of (un)known compounds.

Organic chemistry laboratory is important for several reasons. It introduces students to many different laboratory practices and concepts that will be used in subsequent chemistry laboratory classes (CHEM 2460 and beyond) and in other laboratory situations in biology, pharmacy, and chemical engineering (just to name a few!). It is anticipated that by the completion of this course, students will be familiar with all of the following topics and techniques:

- Safety in the laboratory
- Interpreting and following scientific directions
- Keeping a proper lab notebook
- Names and proper usage of lab instruments
- Understanding of general properties of compounds (including solubility, miscibility, acid/base chemistry, etc.)
- Proper usage of glassware
- Isolation and purification techniques [including filtration, solvent removal, drying solutions, distillations, chromatography (thin-layer, column, and gas) and crystallization/recrystallization]
- Characterization techniques including spectroscopy and melting point determination
- Interpretation of scientific results including percent yield and recovery, melting point, boiling point, IR and NMR spectra, and Rf values

COURSE OBJECTIVES & LEARNING OUTCOMES
Upon completion of this course, the student will be able to:

1. Demonstrate their knowledge of departmental safety rules through their laboratory practice, including the ability to dispose of waste properly.
2. Apply basic stoichiometric algorithms (calculating limiting reagents, theoretical yield, molar ratios) in the context of organic chemistry.
3. Demonstrate a command of the rules for assigning significant figures in their work, specifically in calculations and laboratory measurements and calculations.
4. Understand and be able to use the basic operations of an organic chemistry laboratory including gravity and vacuum filtration, liquid-liquid extraction, simple and fractional
distillation, reflux, recrystallization, thin-layer chromatography, gas chromatography, column chromatography, drying of solids and solutions, and the theories behind these techniques.

5. Know the significance of pK\textsubscript{a} values in experimental steps.

6. Identify and assess the purity of organic compounds using analytical techniques, including melting point, thin-layer chromatography, IR, and gas chromatography.

7. Deduce organic structures using spectroscopic methods, including infrared (IR), \textsuperscript{1}H- and \textsuperscript{13}C-nuclear magnetic resonance spectroscopy, and mass spectrometry.

8. Determine molecular formulas from a mass spectrum by using the Rule of 13 and other techniques.

9. Deduce hydrogen deficiency from a molecular formula and use this information to help deduce a structure.

10. Be able to follow a detailed experimental procedure and construct a flow diagram to illustrate it.

11. Depict and explain detailed chemical mechanisms for all laboratory reactions (and their related reactions).

12. Demonstrate the ability to properly maintain a laboratory notebook.

13. Construct a lab report that includes an analysis of the data collected, and discussion of the outcomes and answers to open questions associated with the experiment.

TEACHING STRATEGIES
This is an asynchronous class with no required weekly meetings. This course is designed to stimulate student learning though the delivery of readings, videos of laboratory techniques, and virtual labs.

PREREQUISITES AND COREQUISITES
Students must have completed the General Chemistry sequence before enrolling in this course (CHEM 1230/1240, 1280/1290) with a grade of D- or better. Students also are required to be concurrently enrolled in (or have successfully passed) Organic Chemistry I lecture (CHEM 2410). Please note that withdrawal from CHEM 2410 during the semester will necessitate withdrawal from CHEM 2460.

REQUIRED TEXTS AND MATERIALS
The following materials are required for this course:

  ISBN: 978-1-337-92830-4

GENERAL TECHNOLOGY REQUIREMENTS
Browser Check Page: Students need to have access to a properly functioning computer throughout the semester. The Browser Check Page (http://www.utoledo.edu/dl/helpdesk/browser-check.html) will enable you to perform a systems check on your browser, and to ensure that your browser settings are compatible with Blackboard (https://blackboard.utdl.edu/webapps/login/), the learning management system that hosts this course.

Software: Student computers need to be capable of running the latest versions of plug-ins, recent software and have the necessary tools to be kept free of viruses and spyware. The computer needs to run the following software, available in the UT Online Download Center (https://www.utoledo.edu/dl/main/downloads.html).

- Word Processing Software
- Adobe Acrobat Reader
- Java Plugin Console
- Adobe Flash Player
- Adobe Shockwave Player
- Google Chrome Browser – Recommended
Internet Service: High-speed Internet access is recommended, as dial-up may be slow and limited in downloading information and completing online tests. This course does contain streaming audio and video content.

Use of Public Computers: If using a public library or other public access computer, please check to ensure that you will have access for the length of time required to complete tasks and tests. A list and schedule for on-campus computer labs is available on the Open Lab for Students webpage.

UT Virtual Labs: Traditionally, on-campus labs have offered students the use of computer hardware and software they might not otherwise have access to. With UT's Virtual Lab, students can now access virtual machines loaded with all of the software they need to be successful using nothing more than a broadband Internet connection and a web browser. The virtual lab is open 24/7 and 365 days a year at VLAB: The University of Toledo's Virtual Labs.

Learner Technical Support can be found here http://www.utoledo.edu/dl/students/learnersupport.html

**TECHNOLOGY REQUIREMENTS FOR EXAMS**

**LockDown Browser + Webcam Requirement**
This course requires the use of LockDown Browser and a webcam for online exams. The webcam can be the type that's built into your computer or one that plugs in with a USB cable. Watch this brief video to get a basic understanding of LockDown Browser and the webcam feature. ([https://www.respondus.com/products/lockdown-browser/student-movie.shtml](https://www.respondus.com/products/lockdown-browser/student-movie.shtml))

**Download Instructions**
Download and install LockDown Browser from this link: ([https://download.respondus.com/lockdown/download.php?id=213815819](https://download.respondus.com/lockdown/download.php?id=213815819))

If you have any issues with the Webcam requirement, please contact Dr. Tun asap to arrange for alternate proctoring arrangements for the exams.

**ACADEMIC POLICIES**
All students at the University of Toledo are expected to read, understand, and follow the academic policies that govern their attendance at the University. These policies include, but are not limited to, academic dishonesty, academic forgiveness, adding and dropping a course, grades and grading, and the missed class policy. Please use the following URL to read a comprehensive list of academic policies that pertain to you in this class and throughout your academic journey: [http://www.utoledo.edu/policies/academic/undergraduate/](http://www.utoledo.edu/policies/academic/undergraduate/). If you have any questions after reading through the policies, please let me know.

**COURSE POLICIES**

*Subject to Change:* Any changes to the Syllabus will be announced through Blackboard or your rockets email

*Student Responsibilities:*
1. Read the laboratory assignment and techniques, and watch related video prior to each laboratory assignment
2. Turn in all work as assigned
**Academic Dishonesty:** The academic honesty policies, as stated in the 2016-2017 UT Catalogue will be STRICTLY ENFORCED. Any student found violating the UT academic honesty policies – including (but not limited to) copying from someone else’s lab report or worksheet, committing plagiarism, or cheating on quizzes or final exam, will be penalized in accordance with these policies.

**Communication:** You are urged to communicate with me about any aspect of the course with concerns you or which might limit your success. Please allow for 24-48 hours, not including weekends or holidays, for a reply from Dr. Tun or your TA. Please also make sure that you include your course number and section number (e.g. CHEM2460-001) either in the subject line or in the body of the email to facilitate the communication. We want you to be successful in this course so let’s work together!

**Drop, Withdrawal, and Incomplete Grades:** Course drop and withdrawal procedures have been set by the University faculty. Pay attention to those add/drop dates as they pass very quickly during the semester! For both dropping the course or withdrawing you should go to Rocket Solution Central in Rocket Hall. You do not need your instructor’s permission for either process. Please note that course registration changes might change your financial aid. A course grade of *incomplete* is given only to those who have completed all but a small percentage of course requirements for an acceptable reason. Remember that if you drop CHEM 2410, you must drop CHEM 2460.

**GRADING POLICIES**
The grade for this course is based upon the following components:

- Safety Quiz/Video: 15 points
- Lab Reports (7 @ 50 pts each): 350 points
- Worksheets (7 @ 20 pts each): 140 points
- Case Studies (2 @ 20 pts each): 40 points
- Quizzes (2 @ 20 pts each): 40 points
- Final Examination: 100 points
- Total Points: 685 points

The grading scale for this class is:

- **A** = 100 – 92%
- **A-** = 91 - 89%
- **B+** = 88 - 86%
- **B** = 85 – 81%
- **B-** = 80 - 78%
- **C+** = 77 - 75%
- **C** = 74 - 70%
- **C-** = 69 - 67%
- **D+** = 65 - 63%
- **D** = 62 - 58%
- **D-** = 57 - 55%
- **F** = 54 - 0%

In order to complete this course with a grade of C+ or higher, you will need to:
- Achieve a score of 50% or higher on the comprehensive lab final examination.
- Achieve at least 75% of the total points for the course.

Please note that extra credit will NOT be given in this class. In order to compensate for differences in grading among TAs, different grading scales or grading adjustments may be used in order to ensure that fair grade assignments are made for each lab section.

**Re-grading:** If you have any questions or concerns about your grade or want to contest a grade for a certain assignment, you need to present the assignment directly to the laboratory coordinator, Dr. Tun, and she will re-grade the assignment – not your TA. There is only a one-week window (after you have received your graded assignment back from your TA) in which you can contest the grading of an assignment, lab report, or quiz, so please check your graded assignments as soon as the assignment grades are posted by your TA.
**Lab Report:** What constitutes a lab report will vary depending on the experiment. For some of the experiments, the lab report will be typing up the information you will be normally including in your lab notebook. For some other labs, the lab report will be simply completing an assignment on Blackboard. The purpose of the lab reports where you need to follow the lab notebook format is to teach you good notebook keeping skills. A handout entailing what is expected in the laboratory notebook will be available on Blackboard. Lab reports’ due dates are listed in the course schedule. Late assignments will receive a 5 point grade deduction for each day late. Any assignment 1 week late or later will receive a zero (0) grade.

**Worksheets:** Spectroscopy worksheet can be found on Blackboard. Worksheets’ due dates are listed in the course schedule. Late assignments will receive a 2 point grade deduction for each day late. Any assignment 1 week late or later will receive a zero (0) grade.

**Quizzes and Final Examination:** There will be two quizzes and one final examination, and they will consist primarily of multiple choice, true/false, matching, or fill in the blank questions. Safety procedures, techniques, historical background of experiments, overall concepts, calculations, and any spectral methods are potential quiz and final exam material. The quizzes and the final exam require the use of LockDown Browser and a webcam.

The final examination will be cumulative and it will be held on the scheduled date listed in the syllabus. In order to complete this course with a grade of C+ or higher, you will need to achieve a score of 50% or higher on the comprehensive lab final examination.

**UNIVERSITY POLICIES**

Your safely and well-being as a University of Toledo student is important to the faculty, staff, and administration; as such please take a minute to review the following university policies that apply to you as a student of the University:

- https://www.utoledo.edu/title-ix/policies.html
- The University of Toledo's Title IX (Sexual Misconduct) Policy - 3364-50-01
- Nondiscrimination 3364-50-02
- Nondiscrimination on the basis of disability - Americans with Disability Act compliance 3354-50-03
- Consensual romantic and/or sexual relationships - Policy 3364-25-65
- Student Code of Conduct 3364-30-04

Please use this URL to view a more comprehensive list of student policies: (the UTC recommends including this link) https://www.utoledo.edu/policies/audience.html/#students

**ACADEMIC ACCOMMODATIONS**

The University of Toledo embraces the inclusion of students with disabilities. We are committed to ensuring equal opportunity and seamless access for full participation in all courses. For students who have an accommodations memo from Student Disability Services, I invite you to correspond with me as soon as possible so that we can communicate confidentially about implementing accommodations in this course. For students who have not established affiliation with Student Disability Services and are experiencing disability access barriers or are interested in a referral to healthcare resources for a potential disability or would like information regarding eligibility for academic accommodations, please contact the Student Disability Services Office by calling 419.530.4981 or sending an email to StudentDisability@utoledo.edu.
ACADEMIC AND SUPPORT SERVICES
The university provides a variety of academic and support services on campus to help you succeed and reach your fullest potential. Whether you need to ask a question, get help with an assignment, seek advice from a counselor, find a job or join a club, UToldeo is there for you! Just use the following URLs to find the academic support or service you need:

- Tutoring: http://www.utoledo.edu/success/lec/
- Library: http://www.utoledo.edu/library/
- Success Coaching: https://www.utoledo.edu/successcoach/
- Student Affairs: http://www.utoledo.edu/studentaffairs/
- Career Services: http://www.utoledo.edu/success/career/

SAFETY AND HEALTH SERVICES FOR UT STUDENTS
In addition to the university policies developed to ensure your health and well-being as a student, there are also a number of on and off campus resources available to support you including a food pantry! Please use the following link to see some additional resources available to you: Campus Health and Safety Contacts Link to Food Pantry: http://www.utoledo.edu/studentaffairs/food-pantry/.
# CHEM 2460-050 Course Schedule

*Please note that this is a tentative schedule and the instructor may make changes if needed.*

<table>
<thead>
<tr>
<th>Dates</th>
<th>Activities</th>
<th>Techniques</th>
<th>Assignment Due Date</th>
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<tr>
<td>8/17-8/21</td>
<td>Safety Video &amp; Safety Quiz (Blackboard)</td>
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<td>8/21</td>
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<tr>
<td></td>
<td>Exp. 1A: “Intro. To Microscale Lab”</td>
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<td>&amp; Exp. 2A-D: “Solubility” (Pages: 1-21)</td>
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<td>8/24-8/28</td>
<td>V-Vis Worksheet (Blackboard)</td>
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<td>Functional Groups Worksheet (Blackboard)</td>
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<td>Exp. 3 (A, C, D): “Crystallization” (Pages: 22-33)</td>
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<td>9/7-9/11</td>
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<td>9/14-9/18</td>
<td>Thin-Layer Chromatography (Blackboard)</td>
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<td>9/21-9/25</td>
<td>TLC (Case study) (Blackboard)</td>
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<td></td>
<td>Quiz 1 (Available from 6:00 AM to 11:59 PM on 9/25)</td>
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<tr>
<td>9/28-10/2</td>
<td>Infrared Spectroscopy Worksheet</td>
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<td>10/5-10/9</td>
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<td>Mass Spectrometry Worksheet</td>
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<td>10/26-10/30</td>
<td>S_n 2 Reactions of Alkyl Halides</td>
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<td>11/2-11/6</td>
<td>GC Worksheet</td>
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<td></td>
<td>Quiz 2 (Available from 6:00 AM to 11:59 PM on 11/6)</td>
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<td>11/9-11/13</td>
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<td>11/13</td>
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<td>Dehydration of an alcohol and GC</td>
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<td>(North Carolina State)</td>
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<td>11/23-11/24</td>
<td>Hall of Fame or Shame (Case Study)</td>
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<td>11/30</td>
<td><strong>FINAL EXAMINATION</strong> (Available from 6:00 AM to 11:59 PM on 11/30)</td>
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