Course Syllabus

CH2421 – Organic Chemistry Lab II
College of Science and Arts
Spring 2016

Lab Supervisor Information

Faculty Lab Supervisor: Andrew Galerneau
Office Location: 601B Chemical Sciences and Engineering Building
Telephone: Office – (906)281-7725
E-mail: aigalern@mtu.edu
Office Hours: MW 4:00pm – 5:00pm or by appointment

General Instructor Information

Additional instructor information can be located on the course website (URL below).

Instructor: Email: Sections: Office (Loc | time):
Ashok Khanal khanal@mtu.edu 01, 02 312D | F: 1-2
Shahien Shahsavari sshahsav@mtu.edu 04, 06 605 | W: 4-5
Prep:
Vaho Begoyan vbegoyan@mtu.edu

Course Identification

Course Number: CH2421-LXX
Course Name: Organic Chemistry Lab II
Course Location: 601 North & South Chemical Sciences and Engineering Building
Class Times: TR 8:05 am – 11:55 a.m. & 1:05pm – 4:55pm

Course Description/Overview

Building from the simple laboratory techniques which we learned last semester, we will be executing a number of syntheses to demonstrate classic organic reactions. Additionally, we will also inspect, through qualitative analysis, the functional groups present in organic compounds. A larger emphasis will also be placed upon technical writing this semester during a group project involving the preparation of an experimental proposal and formal report following the synthesis of a Grignard product.
Course Learning Objectives

We will be executing a number of experiments designed to both provide you with access to organic chemistry synthetic techniques and to demonstrate concepts learned in lecture. Additionally, keeping and maintaining a laboratory notebook is major component of the course. We will also expand upon your ability to research chemistry through library components of the course.

1. Students will execute a range of classic organic reactions which include: Grignard reaction and Friedel-Crafts acylation.
2. Students will record experimental procedures in their lab notebooks to a high degree of detail such that their work could be replicated by another chemist.
3. Students will collaborate to propose and execute a synthesis of a target compound as well as provide a formal report of their findings.

Course Resources

Course Website
- Canvas <https://mtu.instructure.com/>

Required Course Text

Course Fees
There is a required lab fee of $202.00.

Course Supplies
You are required to supply your own safety goggles for this lab. They are available from MTU Bookstore cashier or Chem. Stores, Room B002 of the ChemSci & Eng Bldg. The goggles should be indirectly vented.

Additionally, if you took CH2411, then you should have retained your lab coat. You will be using that lab coat again for CH2421. If you have misplaced that coat, then it will be your responsibility to replace it. If you did not take CH2411 at this institution, then notify your instructor and she/he will supply you with a coat.
Grading Scheme

Grading System

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Percentage</th>
<th>Grade points/credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>93% &amp; above</td>
<td>4.00</td>
</tr>
<tr>
<td>AB</td>
<td>87% – 92%</td>
<td>3.50</td>
</tr>
<tr>
<td>B</td>
<td>82% – 86%</td>
<td>3.00</td>
</tr>
<tr>
<td>BC</td>
<td>76% – 81%</td>
<td>2.50</td>
</tr>
<tr>
<td>C</td>
<td>70% – 75%</td>
<td>2.00</td>
</tr>
<tr>
<td>CD</td>
<td>65% – 69%</td>
<td>1.50</td>
</tr>
<tr>
<td>D</td>
<td>60% - 64%</td>
<td>1.00</td>
</tr>
<tr>
<td>F</td>
<td>59% and below</td>
<td>0.00</td>
</tr>
<tr>
<td>I</td>
<td>Incomplete; given only when a student is unable to complete a segment of the course because of circumstances beyond the student’s control. A grade of incomplete may be given only when approved in writing by the department chair or school dean.</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Conditional, with no grade points per credit; given only when the student is at fault in failing to complete a minor segment of a course, but in the judgment of the instructor does not need to repeat the course. It must be made up within the next semester in residence or the grade becomes a failure (F). A (X) grade is computed into the grade point average as a (F) grade.</td>
<td></td>
</tr>
</tbody>
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Grading Policy

Grades will be based on the following:

<table>
<thead>
<tr>
<th>Item</th>
<th>Points</th>
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</thead>
<tbody>
<tr>
<td>Experiments (6 labs x 95 points each)</td>
<td>570</td>
</tr>
<tr>
<td>Synthesis Proposal</td>
<td>50</td>
</tr>
<tr>
<td>Synthesis Research Journal</td>
<td>50</td>
</tr>
<tr>
<td>Synthesis Experimental</td>
<td>50</td>
</tr>
<tr>
<td>• Conduct(10)</td>
<td></td>
</tr>
<tr>
<td>• Group Evaluation(30)</td>
<td></td>
</tr>
<tr>
<td>• Discussion(10)</td>
<td></td>
</tr>
<tr>
<td>Synthesis Formal Report</td>
<td>100</td>
</tr>
<tr>
<td>Library Sessions (2 x 25 points)</td>
<td>50</td>
</tr>
<tr>
<td><strong>Total Points</strong></td>
<td><strong>870</strong></td>
</tr>
</tbody>
</table>

Points for regular experiments are divided into the following categories:

<table>
<thead>
<tr>
<th>Item</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prelab(Due at beginning of experiment):</td>
<td>10</td>
</tr>
<tr>
<td>Quiz(Issued at beginning of a new experiment):</td>
<td>10</td>
</tr>
<tr>
<td>Experimental Section(Due upon completion of experiment):</td>
<td>40</td>
</tr>
<tr>
<td>Postlab(Due the lab period following completion of experiment):</td>
<td>35</td>
</tr>
<tr>
<td><strong>Total Points</strong></td>
<td><strong>95</strong></td>
</tr>
</tbody>
</table>
For more information on the specifics of each component of the experiment, please review details available on Canvas.

Late Assignments

Students with an incomplete prelab will receive a zero for that assignment and will not be allowed to work in the lab until the prelab has been completed. All late work will receive 0 points if not turned in on time. No excuses will be accepted.

Course Policies

A responsible attitude towards attendance is critical to the efficient operation of this laboratory course. Much of the same responsibility and courtesy shown to an employer are expected from students enrolled in this course, including attendance during the weekly scheduled lab time. Please make note of the following:

1. To make up a lab, you must email OrgMakeup@mtu.edu or obtain permission from the lab faculty advisor. Note: contacting your instructor will not ensure placement into a make-up lab session as they are not responsible for assigning make-up sessions!
2. If after approval of the make-up request you decide to perform the experiment in your own section, please email the lab supervisor. Remember there could be other students whose request was not approved due to lack of space availability.

IMPORTANT ABSENCE POLICY NOTES

- All absences must be made up within one week of the missed lab. To facilitate this, you should email OrgMakeup@mtu.edu or notify the lab supervisor as soon as you know you will miss a laboratory!
- Postlab exercises must be complete in the week they are due. A postlab turned in late will be assigned 0 points.
- Three unexcused absences will result in an F for the course. If you suspect that you will be absent more than once, it is strongly recommended that you obtain validation of your absence from a physician, counselor, or clergy. Present your validation to the Dean of Students for the absence to be deemed “excused”.

SAFETY NOTES

General lab safety protocols are followed. The following are a few general safety guidelines which should be observed. Additional guidelines may be found on Canvas under “Safety Rules”. Failure to follow safe lab practices may result in a point deduction to your experimental score.

- Safety goggles must be worn upon entering the lab.
- Shoes should be closed toed. Sandals and shorts are prohibited.
- Clothes should cover a majority of your skin’s surface and it is strongly recommended that you wear the provided lab coat. Latex gloves are provided for handling hazardous substances. Keep all loose hair tied back.
- Never eat or drink in the lab. This rule covers chewing gum as a food.
- Bags and coats must be stored in the lockers in the hallway. They are a tripping hazard in the lab.
Collaboration/Plagiarism Rules
Lab exercises are to be completed individually. Students may discuss content of exercises but only after working on them individually. Experiments will be performed individually except when partnerships are specified.

University Policies
Academic regulations and procedures are governed by University policy. Academic dishonesty cases will be handled in accordance the University's policies.

If you have a disability that could affect your performance in this class or that requires an accommodation under the Americans with Disabilities Act, please see me as soon as possible so that we can make appropriate arrangements. The Affirmative Action Office has asked that you be made aware of the following:

Michigan Tech complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disabilities Act of 1990. If you have a disability and need a reasonable accommodation for equal access to education or services at Michigan Tech, please call the Dean of Students Office, at 487-2212. For other concerns about discrimination, you may contact your advisor, department head or the Affirmative Action Office, at 487-3310

Academic Integrity:
http://www.studentaffairs.mtu.edu/dean/judicial/policies/academic_integrity.html

Affirmative Action:
http://www.admin.mtu.edu/aaq/

Disability Services:
http://www.mtu.edu/student-affairs/interests/handbook/resources/support-services/#disability

Course Schedule

Additional information and specific notes for each weekly meeting can be found on Canvas under the “Experiment Schedule” page. It is your responsibility to review this information prior to each weekly meeting. Failure to do so will result in your inability to attend lab.

Week 1 (January 12 & 14)
Check-in, safety review, library session for Organic Synthesis

Week 2 (January 19 & 21)
Free Radical Chlorination with Sulfuryl Chloride

PREPARATION: Read experiment, review techniques, and prepare preliminary lab notebook.
TECHNIQUES (Zubrick topics): heating sources, boiling stones, reflux, extraction/washing; drying agent, clamps/clamping, fractional distillation.

01/18 Martin Luther King recess

Week 3 (January 26 & 28)
Continuation of Selective Free Radical Chlorination with Sulfuryl Chloride

PREPARATION: Read experiment and review techniques.
TECHNIQUES (Zubrick topics): gas chromatography.

NOTE: % yield and reactivity calculations are a graded component of the experimental section!

Week 4 (February 2 & 4) – no labs
02/03 Winter Carnival recess begins at 10:00 p.m.

Week 5 (February 9 & 11)
Qualitative Tests for Identification of Carbon-Carbon Unsaturation And Alcohol Functions

PREPARATION: Read experiment, review techniques and prepare a preliminary lab notebook according to the example preliminary notebook.

Week 6 (February 16 & 18)
Diels-Alder Reaction in Water
PREPARATION: Read experiment, review techniques, and prepare preliminary lab notebook.
TECHNIQUES (found in Zubrick): Reflux and thin-layer chromatography.

ADDITIONAL ASSIGNMENT: Read the Week 9 experiment, "Borohydride Reduction of Vanillin" and develop a procedure. An outline of your procedure for this assignment is due during Week 7.

02/16 Career Fair 12:00 p.m. – 6:00 p.m.

Week 7 (February 23 & 25)
Electrophilic Aromatic Substitution: Iodination
PREPARATION: Read experiment, review techniques, and prepare preliminary lab notebook.
TECHNIQUES (found in Zubrick): Rotary Evaporators, recrystallization using two-solvents, and melting points.

REMINDER: Outline for procedure of Week 9 experiment, "Borohydride Reduction of Vanillin", due.
**Week 8 (March 1 & 3)**
Friedel Crafts Acylation; Acetylferrocene

PREPARATION: Read experiment, review techniques, and prepare preliminary lab notebook.
TECHNIQUES (found in Zubrick): Reflux, separation/washing, drying agent, drying tubes, recrystallization, vacuum filtration, melting point determination, products, and infrared.

*03/07 – 03/11 Spring Break*

**Week 9 (March 15 & 17)**
Borohydride Reduction of Vanillin

PREPARATION: Read experimental theory, review procedure (self-prepared) & techniques, and prepare preliminary lab notebook (according to the procedure for this experiment).
TECHNIQUES (found in Zubrick): Products, melting point, recrystallization, & vacuum filtration.

**Week 10-13 (March 22 & 24; March 29 & 31; April 5 & 7; 12 & 14)**
Grignard Synthesis Proposal – Details on Canvas

**Week 14 (April 19 & 21)**
Part I: Introduction to The Science Citation Index (library assignment to be completed on Canvas prior to lab)

Part II: Lab Check-out, Evaluations, and Clean-up

**NOTE:** Any student enrolled in this course must check out on or before the last lab. For further instructions, please see “Early Check-out” under the “Lab And Safety Notes” page on Canvas. Students who do not make arrangements to check out of their drawer will be fined $25.00 in addition to the cost of replacement equipment.

*04/22 The last day of classes*