Course Syllabus
CH2421 – Organic Chemistry Lab II – Section 05
College of Science and Arts
Spring 2010

Lab Supervisor Information
Lab Supervisor: Andrew Galerneau
Office Location: 601B Chemical Sciences and Engineering Building
Telephone: Office – (906)281-7725
E-mail: ajgalern@mtu.edu
Office Hours: WF 10:00am – 12:00pm or by appointment

General Instructor Information
Additional instructor information can be located on the course website (URL below).
Instructor: Email: Teaching Sections:
Andrew Chapp achapp@mtu.edu 01, 05
Xi Lin xilin@mtu.edu 04
Srinivas Mandalapu smandala@mtu.edu 02, 06
Giri Vegesna gkvegesn@mtu.edu 03, 07

Course Identification
Course Number: CH2421-LXX
Course Name: Organic Chemistry Lab II
Course Location: 601N Chemical Sciences and Engineering Building
Class Times: R 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 classical organic reactions. Additionally, we will also inspect qualitative analysis of functional groups present in organic compounds. A larger emphasis will also be placed upon technical writing this semester through two informal reports and one synthesis proposal for a medicinal compound.

Course Learning Objectives
We will be executing a number of experiments designed to both provide you 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 be capable of a high degree of technical writing through the execution of a two-step synthetic proposal.

**Course Resources**

**Course Website**
- Blackboard <https://courses.mtu.edu/>

**Required Course Text**
- A bound lab notebook published by Chemical Education Resources, Inc. (ISBN #087540-249-6) with duplicate pages. (Available in MTU Bookstore.)

**Course Fees**
There is a required lab fee of $169.00.

**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 in the fall, 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 in the fall, 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>90% &amp; above</td>
<td>4.00</td>
</tr>
<tr>
<td>AB</td>
<td>85% – 89%</td>
<td>3.50</td>
</tr>
<tr>
<td>B</td>
<td>80% – 84%</td>
<td>3.00</td>
</tr>
<tr>
<td>BC</td>
<td>75% – 79%</td>
<td>2.50</td>
</tr>
<tr>
<td>C</td>
<td>70% – 74%</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>
</table>

Grading Policy

Grades will be based on the following:

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiments (3 labs x 90 points each, 4 labs x 95 points each)</td>
<td>650</td>
</tr>
<tr>
<td>Synthesis Proposal Rough Draft of Reactions and Precedents</td>
<td>20</td>
</tr>
<tr>
<td>Synthesis Proposal</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>820</strong></td>
</tr>
</tbody>
</table>

Points for regular experiments are divided into the following categories:

<table>
<thead>
<tr>
<th>Category</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 Blackboard.

**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 the supervisor 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 absence 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, please complete an absence request form or notify the lab supervisor *as soon as you know you will miss a laboratory*!
- Postlab exercises must be handed in the week they are due. 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.

**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 Blackboard under “Safety Guidelines”.

- Safety goggles must be worn at all times when chemicals are in use.
- 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.
- Bags and coats must be stored in the coves 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/aae/

**Disability Services:**
http://www.admin.mtu.edu/urel/studenthandbook/student_services.html#disability

**Equal Opportunity Statement:**
Course Schedule

Additional information and specific notes for each weekly meeting can be found on the Blackboard under the “Experiment Schedules” 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, PubChem, and Beilstein, and Semester Project

Week 2 (January 19 & 21)
Selective Oxidation of Alcohols with Pyridinium Chlorochromate

PREPARATION: Read experiment, review techniques, and prepare preliminary lab notebook (for 2 weeks). TECHNIQUES (found in Zubrick): Reflux, reflux and addition, gravity filtration, thin-layer chromatography, nuclear magnetic resonance interpretation, and infrared spectroscopy.

01/18 – Martin Luther King, Jr. Day full day recess.
01/20 – Last day to drop with a refund.

Week 3 (January 26 & 28)
Continuation of Selective Oxidation of Alcohols with Pyridinium Chlorochromate

01/29 – Last day to drop without a grade

Week 4
Select Target for Synthesis Proposal.

02/03 Winter Carnival recess; begins 10:00 PM, February 3.

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)
The Grignard Reaction

PREPARATION: Read experiment, review techniques, and prepare preliminary lab notebook. TECHNIQUES (found in Zubrick): drying glassware, reflux, boiling stones, heating, separation/washing, recrystallization, vacuum filtration, melting point, products, and wet column chromatography.
ADDITIONAL ASSIGNMENT: Read the Lab 8, Part II, experiment, "Borohydride Reduction of Vanillin" and develop a procedure. An outline of your procedure for this assignment is due during Lab 6.

**Week 7 (February 23 & 25)**
*Continuation of the Grignard Reaction: Column Chromatography*

REMINDER: Outline for procedure of Lab 8, experiment, "Borohydride Reduction of Vanillin" due.

ADDITIONAL ASSIGNMENT: A flow diagram of the procedure for the final experiment, "Separation and Identification of an Unknown Binary Mixture" is due during the Lab 7. This will give teaching assistants an opportunity to grade and return the flow diagrams before the experiment. PREPARATION: (a) Read experiment; (b) Read Zubrick (topics): recrystallization and gravity filtration.

**Week 8 (March 2 & 4)**
Friedel Crafts Acylation; 4-Methoxybenzophenone

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

REMINDER: A flow diagram of the procedure for the experiment "Separation and Identification of an Unknown Binary Mixture" is due.

*03/05 Last day to drop full semester courses with a “W”.*

**Week 9**
*03/08 – 03/12 Spring Break*

**Week 10 (March 16 & 18)**
*Rough draft of reaction steps and precedents for Synthesis Proposal are due.*

Part I: Continuation of Friedel Crafts Acylation; 4-Methoxybenzophenone

PREPARATION: Review experiment and techniques: melting point determination, IR.

Part II: 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 11 (March 23 & 25)**
Part I: Identification of an Alcohol or Carbonyl Compound by Means of Three Reagents
PREPARATION: Read experiment, review techniques, and prepare preliminary lab notebook with tables similar to: Example Table for Preliminary Notebook.

Part II: Separation and Identification of an Unknown Binary Mixture

PREPARATION: Read experiment introduction, review techniques, and prepare a flow diagram of the procedure [2 weeks prior]. TECHNIQUES (found in Zubrick): extraction and washing, drying agent, simple distillation, recrystallization, vacuum filtration, melting point.

**Week 12 (March 30 & April 1)**
Continuation of Separation and Identification of an Unknown Binary Mixture

PREPARATION: Review procedure performed, prepare/outline procedures needed to finish, and review techniques.

**Week 13 (April 6 & 8)**
Continuation of Separation and Identification of an Unknown Binary Mixture

**Week 14 (April 13 & 15)**
Part I: Continuation and Completion of Separation and Identification of an Unknown Binary Mixture

Part II: Introduction to The Science Citation Index (library assignment)

**Week 15 (April 20 & 22)**
Final Draft of Synthesis Proposal due on or before April 23, 2010.

Lab Check-out 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. 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.

04/26 – 04/30 Final Exams