Course Syllabus: CHE 332L—Organic Chemistry II Laboratory—Spring 2019

Section: 022 & 023
Instructor: Russell J. Franks, Ph.D.
Office: NM 114
11:00-12:00 MWF
10:00-12:00 T
Office Hours: Other times by appointment
Classroom: M 130/C 209/C 210
Class Time: 1:00—4:50 pm W
Email: rjfranks@sfasu.edu
Phone: 468-2199

Catalog Description: Organic Laboratory – synthesis and characterization of organic compounds

Prerequisite: CHE 331 & 331L (or their equivalents) with a minimum grade of “C”

Corequisite: You must be currently enrolled in CHE 332 or have already had CHE 332 (or its equivalent)

Required Materials:
- A standard O-Chem lecture text, e.g. Karty, Wade, or Brown, et al., etc.
- Notebook paper & pencils
- Lab handouts will be posted on D2L throughout the semester. It is your responsibility to print these out, study them, and bring them to lab with you
- A scientific calculator—Bring to lab with you EVERY TIME!

Laboratory Notebook: You must use a spiral-bound lab notebook.
- If you took CHE 133L/134L at SFA, you will use the same type of notebook.
- You may use the notebook from other classes, but only with my permission.
- Notebooks may be purchased from Dr. Frantzen (M119) for $20 (cash only).
- This type of notebook is the ONLY type that will be allowed for this lab. No other type of notebook will be accepted.

Required Supplementary Readings:
Handouts will be distributed prior to each lab. You are expected to read and study these handouts carefully.

Course Objectives:
Students will learn principles of organic chemistry in the laboratory. In the process, they will familiarize themselves with a broad range of techniques and procedures important to the successful practice of experimental organic chemistry. Special emphasis will be placed on:
- the safe handling of chemicals
- the proper manipulation of labware and instrumentation specific to the organic chemistry laboratory
- the maintenance of proper laboratory experimental records
- organic spectroscopy: the use of MS, IR, and NMR in structural elucidation
- the use of scientific report writing as a means of communicating experimental results and as a means of demonstrating an overall understanding of the chemical principles and concepts used during laboratory activities.

Student Learning Outcomes: By the end of the semester, the student should be able to:
- Follow a published procedure to:
  - Perform an organic reaction successfully
  - Isolate and purify the product of an organic reaction
- Analyze spectroscopic data (MS, IR, 1H-NMR) in order to:
  - Elucidate the correct structure of a molecule
  - Assign correctly various spectral attributes and features to a particular portion of a molecule’s structure
- Write a good laboratory report including:
  - Recording his/her procedure, data, and observations in the laboratory notebook
  - Demonstrating in writing that he/she understood the chemical & physical principles involved in laboratory techniques & manipulations
  - Following established principles & conventions for communicating laboratory data & results
Course Syllabus: CHE 332L—Organic Chemistry II Laboratory—Spring 2019

Course Requirements:
Your grade will be determined by evaluating your performance in lab activities. A list of these activities and their weight in the overall semester grade is shown below:

<table>
<thead>
<tr>
<th>Lab Activity</th>
<th>% of Semester Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectroscopy Quizzes (best 3 of 4 quiz grades)</td>
<td>10%</td>
</tr>
<tr>
<td>Major Spectroscopy Quiz (best of 2)</td>
<td>20%</td>
</tr>
<tr>
<td>Aromatic Oxidation Project</td>
<td>15%</td>
</tr>
<tr>
<td>Indigo Synthesis</td>
<td>15%</td>
</tr>
<tr>
<td>Nylon Synthesis</td>
<td>15%</td>
</tr>
<tr>
<td>Biodiesel Project</td>
<td>25%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Method of Evaluation:
Grading scheme for each lab activity:

- In each activity, you will be evaluated on the following: your preparation for the lab activity, the lab notebook you keep while performing the activity, the report you write after the lab activity has been completed, and your lab technique, i.e. how well you have mastered the technical and manipulative skills that are needed for the lab activity. You will be provided with other handouts that contain more specific information regarding lab notebooks and report writing. **It is your responsibility to read these materials and comply with the guidelines outlined therein.**

Expectations:
O-Chem lab is an experiential course. You are expected to learn from participating in the experiment using the knowledge you have gained from the lecture portion of the class to improve your laboratory results. You will **NOT** be given all of the information you will need! You are expected to be resourceful and learn to find information on your own. **While the instructor will do his best to ensure your safety, each student is responsible for his/her own learning from the laboratory activities.**

Spectroscopy Quizzes:
Spectroscopy is how we view molecules and is one of the most important skills in organic chemistry. We will practice these skills early so we can utilize these skills in the laboratory. You should become very familiar with the spectroscopy chapters in your organic lecture text while also using chapters 32 & 33 from Zubrick’s “The Organic Chem Lab Survival Manual”. Along with the examples done in class, you must practice spectroscopy problem-solving techniques using the assigned problems from the lecture text. In CHE 331L, you were introduced to the usage of MS, IR, and $^1$H-NMR data to determine the structures of organic molecules. In CHE 332L, we will build upon these ideas and introduce the usage of $^{13}$C-NMR as well as multiple-pulse NMR techniques (DEPT) that are very useful in solving structural problems. We will have three Spectroscopy Quizzes at the beginning of the semester. Your best three of the four Spectroscopy Quiz grades will be counted. In addition, we will have two Major Spectroscopy Quizzes in the latter part of the semester. Your best grade out of the two Major spectroscopy Quizzes will be counted.

Lab Project:
You will engage in two lab projects for the majority of the semester. We will study the oxidation of substituted aromatic compounds by KMnO₄. In addition, we will synthesize biodiesel fuels from a variety of sources. Once the biodiesel samples have been synthesized, we will characterize them. You will work in small groups of 2-3 students during this project.
Notebook & Pre-lab outline:
The student should be prepared for the experiment prior to the laboratory. This is primarily a safety concern, but prepared students often complete experiments more efficiently and obtain the necessary data required to write excellent reports. Organization is clearly important, and is the most important feature of the laboratory notebook. A well-organized organized notebook is more important than a neat notebook. Notebook mistakes can be crossed out and corrected (as long as a brief explanation for the correction is inserted and dated in the margin) for accuracy. An outline that covers the procedure to be performed must be prepared on LOOSE-LEAF PAPER prior to lab. This may either be handwritten or done on a computer (your choice). Your pre-lab outline MUST NOT be written within your lab notebook. The pre-lab outline should be done in a stepwise, "cookbook" fashion. You should use the outline as your primary source for guidance while performing the lab. Failure to prepare a proper outline prior to lab will result in you not being allowed to enter the lab until you have prepared a proper outline. This might result in you not having a sufficient amount of time to perform the day’s experiment, and can result in you being sent home for the day. If this should happen, you can expect to receive a substantial penalty on the lab in question.

The notebook is the most important document produced during the laboratory. It is this information that will be used for the writing of reports, and the determination of how modification of the experiment may affect change. You must NEVER erase or white-out anything from the notebook! Everything written into the notebook should be permanent, thus you should only write in black ink. The first experiment will be used to demonstrate the value of a good lab notebook.

Reports:
The reports will be either brief or full and complete descriptions describing the experiment. Your instructor will provide the information you are expected to present in each report. It is important that you write clearly, concisely, and correctly. If you have a question or complaint about how a particular lab report was graded, you must notify the professor in writing no later than five (5) class days after the lab report was returned to you. Your written appeal should discuss the specific nature of the problem. Grades will NOT be changed if you do not make an appeal within the five class-day period. It is recommended that you keep ALL graded papers until the end of the semester. In the event of a question or discrepancy about a grade on a particular activity, you will be required to produce the item in question before any grade is changed.

Note: If you drop the course, you MUST still check out of lab. If you check out at the end of the semester and do not clean your equipment satisfactorily, your course grade will be penalized by one letter grade!

Attendance Policy: You cannot do the lab if you are not present (obviously)

- There are no “make up” labs.
- You are responsible for notifying the professor [NOT the TA] (in writing) if you know that you will have to miss a lab
- If you miss one laboratory for an excused reason (as defined by the SFA Policies and Procedures Manual), you can be allowed to complete a lab activity during another lab activity (only on the day that you are scheduled to be in lab). This is only allowed with the professor’s explicit permission.
- If you miss a laboratory for an unexcused reason, you will receive a grade of zero (0) on that lab and any quiz that might be given on the day missed.
- A total of two unexcused absences will result in a grade of zero on the missed lab AND your semester lab grade will be lowered by one letter grade
- Three or more absences will result in an automatic F in the course
- If there are extenuating circumstances (e.g. serious illness), you are responsible for notifying the professor as soon as possible

Semester Withdrawals:

Please note: The last day to drop this course without receiving a WP or WF on your transcript is Wednesday, Mar. 27th. If you drop the course, you MUST check out of the lab also. If you do not check out of lab, the Registrar will not authorize the drop.
Academic Integrity Policy:

Each student should acquaint him/herself with the University's codes, policies, and procedures involving academic misconduct, grievances, sexual and ethnic harassment, and discrimination based on disability. Copies of the SFA Policies and Procedures Manual can be obtained in print or online from the Office of Academic Affairs (http://www.sfasu.edu/upp/pap/academic_affairs.html)

Students engaging in academic misconduct (including cheating, plagiarism, or any other action that can improperly affect evaluation) will be subject to sanctions in accordance with SFA Academic Integrity Policies. I will recommend a grade of "F" for the course and expulsion from the University for any such violations.

Academic Disabilities Policy:

Stephen F. Austin State University is committed to providing reasonable accommodation for all students with disabilities. Students with disabilities who require accommodations in this course are requested to speak with me as early in the semester as possible. Students with disabilities must be registered with the Office of Disability Services prior to receiving accommodations in this course. The Office of Disability Services is located in Human Services Bldg., Room 325, (936) 468-3004, or (936) 468-1004 (TDD).

Lab Conduct Policy

- You are expected to pay careful attention during the pre-lab discussion. This is your time to ask questions if you are unsure of how to perform a particular manipulation. Texting, internet surfing, studying for other classes, or any other sort of behavior will NOT be tolerated. You will be kicked out of lab and will receive a grade of zero on that day's activities.
- You are expected to follow the Chemistry Dept. safety rules AT ALL TIMES while in lab. A copy of the departmental safety agreement will be provided for you to read and sign.
- Horseplay in the lab is ABSOLUTELY FORBIDDEN. If you are caught engaging in horseplay, you will be removed from lab for the day and will receive a grade of zero (0) on that lab activity. This is the only warning you will receive about horseplay.
- Goggles must be worn AT ALL TIMES whenever ANYONE is working in the lab. If your goggles fog, step into the hallway to clean them. Failure to wear goggles in lab will result in you being removed from the lab for the day and receiving a grade of zero (0) on that lab activity. This is the only warning you will receive about wearing goggles.
- You are also expected to conduct yourself in a mature and responsible manner while in lab. NOTE: Usage of cell phones (including text messaging) while in lab is PROHIBITED. Turn your phones off before coming into lab. You will be removed from lab for the day and will receive a grade of zero (0) if you use your cell phone in lab
- Lab begins promptly at the scheduled time. BE ON TIME! Chronic tardiness problems can result in penalties to your grade.
- You are expected to arrive for lab well-prepared for the scheduled activities. This includes having done any assigned reading and any other assigned pre-lab preparation.
- Repeated or serious conduct problems will result in you being removed from lab permanently, and can result in disciplinary action from the university.
Organic Laboratory Safety:

- You are not in freshman chemistry anymore. The organic lab can be a dangerous place. Many of the chemicals you will use are toxic, corrosive, flammable, or otherwise hazardous. You do not need to be afraid of these chemicals; however, **you DO need to have a healthy respect for them**. If you have a question about how to handle a chemical or piece of equipment properly, ask the TA or the professor.
- The best safety device you have in lab rests on your shoulders. You have a brain. Use it! Think **BEFORE** you do things.
- Many accidents or mishaps in lab can primarily be attributed to two main factors:
  - **Failure to prepare thoroughly for lab** - You MUST know what chemicals you will be using and know the hazards associated with them. Pay special attention to any special warnings or directions given in the text or handouts. Listen attentively during the pre-lab lecture. **Ask questions if you are unsure of how to handle a particular chemical or how to do a procedure**. It is much better for you to ask and take a few minutes of class time than for you to do something incorrectly, ruin an experiment, or possibly create a safety hazard in the lab.
  - **Momentary episodes of carelessness** - Many times students simply forget that they should (or should not) do something until they do it (or don’t do it). At that point, it is too late. **THINK** about what you are doing. If you see a classmate doing something incorrectly, tell him/her. A lot of these problems can be alleviated or even avoided through proper, thorough preparation.
- A copy of the SFASU Department of Chemistry safety rules has been provided for you. **READ THEM!!!** You MUST sign this form before being allowed to participate in lab.
- You are expected to follow all safety rules AT ALL TIMES while in lab.
- **ATTENTION FEMALE STUDENTS:** IF YOU ARE PREGNANT, OR IF YOU FIND OUT YOU HAVE BECOME PREGNANT WHILE TAKING THE LAB, PLEASE NOTIFY THE PROFESSOR AT ONCE!
- **APPROVED SAFETY GOGGLES** **MUST** **BE WORN** **IN THE LAB WHENEVER ANYONE IS CONDUCTING AN EXPERIMENT! SAFETY GLASSES ARE NOT ALLOWED. IF YOU ARE CAUGHT NOT WEARING GOGGLES, YOU WILL BE KICKED OUT OF LAB AND WILL RECEIVE A ZERO FOR THAT DAY’S LAB.** Goggles must fit tightly around the eyes and be “splash-proof”. Goggles are provided for you in your lab drawer. If the goggles do not fit properly, or are not comfortable, please notify the TA or the professor immediately so that we can get you better goggles.
- **NO FOOD, DRINK, or TOBACCO USAGE** is allowed in the lab! Water bottles, etc. should be kept in your backpack.
- **NO EXPOSURE OF SKIN BELOW THE NECK, EXCEPT FOR THE ARMS** is allowed in the lab!
  - This lab is a 100% “cleavage-free” zone. This applies to both front and back cleavage.
  - This means that tank-tops and sleeveless shirts are **NOT** allowed
  - No shorts or open-toe shoes (sandals & flip-flops). **YOU WILL NOT BE ALLOWED TO PARTICIPATE IN LAB IF YOU ARE WEARING OPEN-TOED SHOES.** If you often wear flip-flops to class, we recommend that you store an old pair of tennis shoes in your lab drawer and change shoes before lab. In the warmer months, if you wear shorts to class, bring a pair of sweats with you and change before lab.
  - Wear comfortable shoes! You will be on your feet the whole time.
  - Don’t wear nice (or expensive) clothing or shoes to lab. You will get chemicals on them, even if you are careful. Oftentimes, you won’t even realize that you got something on your clothing until you wash it and see a hole in it.
- **Backpacks must be stored on the racks on the lab benches, NEVER on the floor or benchtop.**

The only things you should have with you when doing the lab are: your lab notebook, pen, calculator, and pre-lab outline. Lab texts should NOT be out during lab.

I reserve the right to change any items contained in this syllabus. This includes, but is not limited to: course content, scheduled dates, grade cutoffs, and fraction(s) of final grade assigned to individual components of the course. If I need to make such changes, I will inform you of the changes in writing. **This syllabus in no way constitutes a legally-binding contract on my part.**
<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/23-1/24</td>
<td>• No lab activities scheduled</td>
</tr>
<tr>
<td>1/30-1/31</td>
<td>• Introduction &amp; class policies</td>
</tr>
<tr>
<td></td>
<td>• $^{13}$C-NMR spectroscopy &amp; DEPT techniques</td>
</tr>
<tr>
<td>2/6-2/7</td>
<td>• Techniques for solving spectral problems</td>
</tr>
<tr>
<td></td>
<td>• Overview &amp; discussion of aromatic oxidation project</td>
</tr>
<tr>
<td></td>
<td>• Lab safety &amp; Check-in</td>
</tr>
<tr>
<td></td>
<td>• Spectroscopy Quiz #1</td>
</tr>
<tr>
<td>2/13-2/14</td>
<td>• Aromatic Oxidation Project—Week 1</td>
</tr>
<tr>
<td>2/20-2/21</td>
<td>• Aromatic Oxidation Project—Week 2</td>
</tr>
<tr>
<td></td>
<td>• Spectroscopy Quiz #2</td>
</tr>
<tr>
<td>2/27-2/28</td>
<td>• Aromatic Oxidation Project—Week 3</td>
</tr>
<tr>
<td></td>
<td>• Spectroscopy Quiz #3</td>
</tr>
<tr>
<td>3/6-3/7</td>
<td>• Indigo Synthesis</td>
</tr>
<tr>
<td></td>
<td>• Spectroscopy Quiz #4</td>
</tr>
<tr>
<td>3/13-3/14</td>
<td>• Nylon Synthesis</td>
</tr>
<tr>
<td></td>
<td>• Major Spectroscopy Quiz #1</td>
</tr>
<tr>
<td></td>
<td>• Turn in lab report for Nylon Synthesis</td>
</tr>
<tr>
<td></td>
<td>• Turn in lab report for Aromatic Oxidation Project</td>
</tr>
<tr>
<td>3/20-3/21</td>
<td>• No lab activities scheduled (Spring Break)</td>
</tr>
<tr>
<td></td>
<td>• Turn in lab report for Indigo Synthesis</td>
</tr>
<tr>
<td>4/3-4/4</td>
<td>• Biodiesel Project: Synthesis-Part 2</td>
</tr>
<tr>
<td></td>
<td>• Major Spectroscopy Quiz #2</td>
</tr>
<tr>
<td></td>
<td>• Turn in lab report for Aromatic Oxidation Project</td>
</tr>
<tr>
<td>4/10-4/11</td>
<td>• Biodiesel Project: Characterization-Part 1</td>
</tr>
<tr>
<td>4/17-4/18</td>
<td>• No lab activities scheduled (Easter Holiday)</td>
</tr>
<tr>
<td>4/24-4/25</td>
<td>• Biodiesel Project: Characterization-Part 2</td>
</tr>
<tr>
<td>5/1-5/2</td>
<td>• Biodiesel Project: Characterization-Part 3</td>
</tr>
<tr>
<td>5/8-5/9</td>
<td>• Clean-up &amp; Check-out</td>
</tr>
<tr>
<td></td>
<td>• Turn in report for Biodiesel Project</td>
</tr>
</tbody>
</table>