A. **Instructors:** Dr. Crystal Young, Assistant Professor; and Dr. Robert Ellison, Visiting Instructor, Department of Chemistry & Physics

B. **Course Description:**
To study the laboratory techniques used to handle chemicals while determining their physical, chemical, & spectroscopic properties. An effort is made to have the lab and lecture topics relate to each other. The labs will emphasize the proper use of common laboratory equipment, record observations, making measurements, correctly interpreting data, and writing a clear report on their conclusion. Safety in the laboratory will have the highest priority.

C. **Course Objectives:**
1. To stress the importance of practicing laboratory safety.
2. To instruct students in the proper use of laboratory equipment.
3. To develop students observation and interpretation skills.
4. To provide opportunities for students to develop their communication skills.

D. **Required Materials:**
1. A 100 page carbonless copy lab notebook. The department has copies of these notebooks available for $14.
2. UST Approved Safety Goggles and Lab Coat (available for $30 from Chemistry Department)
3. Dish detergent and a permanent ink marker pen.

E. **Safety:**
Safety is an essential component of each lab session. Safety training will be conducted during the first lab period and a quiz administered following the presentation. You will not be allowed to conduct experiments without completing the training and earning a perfect score on the quiz. Disregard for lab safety will result in your immediate dismissal from the lab and a zero on that week’s laboratory assignment.
1. You must wear appropriate clothing and shoes, safety goggles and a lab coat at all times in lab.
2. You must obey all laboratory safety rules (refer to the Lab Safety Procedures handout found on Blackboard).
3. You may not work alone in lab. An instructor must be present whenever students are working in lab.
4. All students must sign the “Chemistry Department Safety Agreement” (attached).

G. **Grading:**

<table>
<thead>
<tr>
<th></th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab Citizenship</td>
<td>10</td>
</tr>
<tr>
<td>Lab Notebook</td>
<td>45</td>
</tr>
<tr>
<td>Post-lab Reports</td>
<td>45</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>Grade</td>
<td>Range</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>A</td>
<td>93-100</td>
</tr>
<tr>
<td>B</td>
<td>83-85</td>
</tr>
<tr>
<td>C</td>
<td>73-75</td>
</tr>
<tr>
<td>D</td>
<td>60-65</td>
</tr>
</tbody>
</table>

Missing 2 or more labs will result in a failing grade for Chem 2144.

All lab entries in your notebook must be your own work. Any data that is the same as another person’s work will result in no credit given for that lab experiment and will be submitted to the university’s academic committee as a case of academic dishonesty.

**Lab Citizenship:** This is a grade based on your performance in lab. It is based on your actions and attitude in lab regarding issues such as your adherence to lab safety, proper waste disposal, and keeping all lab areas in a clean and orderly fashion. Each student will be assigned a week when they will be responsible for cleaning up the lab at the end of the period.

**Lab Notebook:** We will be using a 100 page carbonless copy lab notebook this semester. The outside front cover of the notebook must indicate the student’s name and course number and section letter. You will turn in a copy of the pre-lab entries and during lab entries at the end of each lab.

**Purpose of the notebook:** A lab notebook is a complete and accurate record of your lab work. It should serve as an official source of what the student did in the lab and what the student observed.

**Pre-lab entries:** Prior to the start of lab you should record in your notebook the following:

1. Title of Experiment
2. Purpose. The purpose should be one sentence describing the goal of the experiment.
3. A stoichiometric chemical equation with structures of reactants and products and an indication of catalysts and conditions shown.
4. Materials list: This should list the names of the chemicals used and the following information about each chemical.
   a. Chemical formula
   b. Chemical structure
   c. Physical data: the melting or boiling point (depending upon its physical state at room temperature), the molecular weight and the density (if a liquid at room temperature). The reference source must be indicated.
   d. You must indicate the primary safety hazards for each chemical being used. For example the following are typical hazards: flammable, toxic, corrosive, irritant, oxidizer, and carcinogen. This information can be found on a number of websites (sigmaaldrich.com, wikipedia.org, ChemSpider.com, and many others).
5. The procedure that you will follow. BRIEFLY state the steps that are going to be done during the experiment. This may be presented as an outline or as a flow chart.

You must have all pre-lab entries completed before you will be allowed to participate in lab.
During lab entries: Record data and observations. This is the most important part of the lab write-up. The student is to make entries directly into the notebook as the experiment is going. Examples of items to put in notebook:

1. Record amounts of materials used and calculate mmoles of each reagent.
2. Record observations (for example: changes in color, precipitation, dissolution) during the experiment. Comments on problems encountered and techniques used should also be included.
3. Record amount of purified product isolated (for % recovery or % yield calculations).
4. Record melting points of products.
5. Attach printouts from instruments (GC-MS data, FT-IR spectra).
6. Any calculations that are part of the lab conclusions must be worked out and appear in the notebook as a during lab entry.

A copy of the pages from the notebook must be turned in at the end of each lab.

Post-Lab Report: A post-lab report containing the results and conclusions for each lab experiment are to be submitted electronically to your lab instructor (see the details outlined below).

1. Title of Experiment
2. Purpose: This should be the same purpose from your pre-lab entry.
3. Results: This section includes the results of your experiment as well as any observations made during the experiment. This is where key findings should be discussed. Additionally, include whether the results of the experiment were as expected. If they were different from the expected results, give a reasonable explanation as to why.
4. Conclusions: This section includes an overall evaluation of your results. It should include statements indicating what was learned from the experiment. Additionally, you may wish to mention any modification to the procedure that you feel might improve the outcome of the experiment.

Each write up is due two days after the completion of the lab experiment at 5:00PM. Reports submitted after this due date and time will receive a 10% point deduction for every 2 days that the assignment is late.

Details for submitting lab write-ups: Post lab write-ups are to be electronic submissions sent as an e-mail attachment. Your attached file needs to have the following file name: last name, first initial, and experiment number. For example, Jane Doe’s submission for lab experiment 1 would have the file name: doe{j1}. The document must be submitted as an MSWord (.doc or .docx) file. Your name must also be included on the first page of the document.

Lab Lockers and Breakage Fees
Each student will be issued a lab locker and drawer with a key. There will be a $5 charge for a lost key. Make sure you lock your locker and drawer before leaving the lab. Your equipment will be inventoried at the start and end of the semester. The lab glassware and equipment is not covered by the “lab fee” of the University. You will be charged for any missing or broken items.
<table>
<thead>
<tr>
<th>Week of</th>
<th>Lab Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Jan</td>
<td>Safety Quiz/Lab check-in</td>
</tr>
<tr>
<td>19 Jan</td>
<td>MLK Holiday Spectroscopy Lecture and Assignment</td>
</tr>
<tr>
<td>26 Jan</td>
<td>#1 Reduction of a ketone (9-fluorenone) and Thin Layer Chromatography</td>
</tr>
<tr>
<td>2 Feb</td>
<td>#2 Oxidation of p-methoxybenzyl alcohol</td>
</tr>
<tr>
<td>9 Feb</td>
<td>#3 Esterification (Synthesis of Aspirin)</td>
</tr>
<tr>
<td>16 Feb</td>
<td>#4 Benzopinacol rearrangement</td>
</tr>
<tr>
<td>23 Feb</td>
<td>#5 Diels-Alder reaction (anthracene and maleic anhydride)</td>
</tr>
<tr>
<td>2 Mar</td>
<td>#6 Nitration of Methyl Benzoate</td>
</tr>
<tr>
<td>9 Mar</td>
<td>Spring Break No Lab</td>
</tr>
<tr>
<td>16 Mar</td>
<td>#7 Friedel Crafts acylation of anisole</td>
</tr>
<tr>
<td>23 Mar</td>
<td>#8 Synthesis of Acetanilide (amide from amine)</td>
</tr>
<tr>
<td>30 Mar</td>
<td>#9 Diazotization reactions</td>
</tr>
<tr>
<td>6 Apr</td>
<td>#10 Qualitative organic Analysis</td>
</tr>
<tr>
<td>13 Apr</td>
<td>#11 Condensation of Benzil with 1,3-diphenylpropan-2-one (Aldol condensation)</td>
</tr>
<tr>
<td>20 Apr</td>
<td>Lab check out</td>
</tr>
<tr>
<td>27 Apr</td>
<td>Last week of classes</td>
</tr>
</tbody>
</table>
Chemistry Laboratory Safety Agreement

At all times, when I am working in the Chemistry laboratory, I will use good laboratory safety practices. While in the laboratory, the following will be my guide to laboratory safety.

I WILL:

1. Wear safety goggles at all times.
2. Wear clothing that protects my body and feet and prevents accidents; including pants or knee long shorts or skirts, close-fitting sleeves, closed shoes, etc. (no shorts, no mini-skirts, no T-shirts, no high heels, no sandals, no dangling belts, no large jewelry, no loose long hair, etc.).
3. Understand what I am to do in each experiment. In doubt I will ask the instructor. Do only assigned experiments, following the procedure in the laboratory manual.
4. Be aware of the location of all safety equipment: fire extinguisher, eyewashes and showers, safety blankets, first aid kit and sand buckets.
5. Never work in the lab without the instructor being present, will carry out experiments only in the assigned laboratory room, and will not enter chemical prep rooms and storage rooms.
6. REPORT ALL ACCIDENTS TO THE INSTRUCTOR IMMEDIATELY, no matter how minor. Comment on a neighbor engaging in an unsafe practice or operation including telling the instructor if necessary.
7. Never put anything in my mouth: items, chemicals, food, or drinks. Never inhale gases or vapors unless instructed to do so.
8. Read carefully all labels on chemicals and waste bottles. Will not pour chemicals back into their original containers, and will close all containers after I use them.
9. Dispose of waste or excess chemicals according to the instructor’s directions.
10. Use the fume hood when instructed to do so.
11. Keep my laboratory bench and work area clean and free of items not related to the experiment.
12. Dispose of broken glass only in the container marked for glass disposal.
13. Clean up any spill immediately by the approved method as it was explained by the instructor. Report serious spills and breaking of thermometers to the instructor.
14. Dispose of all trash in the assigned containers properly. Make sure the laboratory is clean and wash my hands before I leave.

I have read carefully the above and have listened to the discussion of Safety and Laboratory Rules. I understand their importance for the safety of all people in my laboratory. I recognize my responsibility to abide by the Safety and Laboratory Rules while in the Chemistry laboratory. In addition, I agree to check out of the laboratory with the instructor before the end of the semester, even if I drop the course.

Chemistry Course #__________________ Section #_____________ Drawer #_____________
Signature _____________________ Name (print)____________________ Date____________
Instructor’s Name (print) ____________________________