**Syllabus for CHEM 2211**

**Course Objective:** The goal of this combined lecture/laboratory course is to develop the student's mastery of chemical technique for quantitative measurements, as well as to gain a fundamental understanding of the chemical principles underlying those measurements. Lecture topics will provide the student with the theoretical basis for each week's experiments. The laboratory will provide the student the opportunity to master a particular laboratory technique and apply it to a specific analysis.

**Instructor:**

**Laboratory Coordinator:**

**Teaching Assistants:**

**Lecture:**

**Laboratories:**

**Required Text:** *Quantitative Chemical Analysis*, 6th, 7th, or 8th Edition by Daniel C. Harris

*****AN IMPORTANT NOTE REGARDING THIS TEXTBOOK*****

The Harris book is an excellent one. The approach he takes to problem solving is very good, and the reality checks he provides with respect to "real world" situations are highly relevant. However, it is huge, dense, and portions of it go far beyond the scope of this course. I will, to the degree I am able, try to focus your reading to the sections of the book that are directly related to this course. Beyond those readings, treat this book as a reference. It will be helpful to you for a long time if you choose a career in chemistry or biochemistry. In the short-term, please don't become overwhelmed by it. Follow my lead, and you should be able to navigate it very well.

**Required On-Line Content:** Sapling Learning – online homework and in-class problem sets (cost = $29.99). Log-in instructions are on page 7 of this syllabus.

**Optional On-Line Content:** Khan Academy – chemistry videos from a 'different' perspective. Some people learn differently and at different paces. Khan Academy provides the opportunity to review some of this course's content outside of the classroom in a visual mode. You are free to use these videos as you see fit – they may help some folks, while they may annoy others.
Relevant Videos:
Stoichiometry
Stoichiometry: Limiting Reagent
Suspensions, Colloids and Solutions
Solubility
Keq Intuition
Keq derivation intuition
Heterogenous Equilibrium
Le Chatelier’s Principle
Introduction to pH, pOH, and pKw
Acid Base Introduction
pH, pOH of Strong Acids and Bases
pH of a Weak Acid
pH of a Weak Base
Conjugate Acids and Bases
pKa and pKb Relationship
Buffers and Henderson-Hasselbalch
Strong Acid Titration
Weak Acid Titration
Half Equivalence Point
Titration Roundup
Introduction to Oxidation States
More on Oxidation States
Hydrogen Peroxide Correction
Redox Reactions
Galvanic Cells

Please note that MANY of these Khan chemistry videos contain errors, although the basic premise and overall content is sound. If you find an error in a video, please email me the following information: video title, time point in the video where the error occurs, what the error is, and how would you correct the error. If you are the first person in the class to correctly identify and correct the error, I will add 20 points to your overall homework score.

Grading: The course grade will be calculated based on the student performance in lab (pre-lab questions and reports) and lecture (homework, exams, on-line quizzes).

Specifically, the following items are the GRADED portions of this course:
1. Eleven (11) pre-lab question sets (3%)
2. Eleven (11) laboratory grades (20%)
3. One (1) laboratory practicum (10% - NOTE – this is worth MORE than each laboratory grade)
4. Eighteen (18) homework sets (12%)
5. Three (3) in-class hour exams (35%)
6. One (1) cumulative final exam (20%)

The Grade Replacement Plan: The Final Exam will be divided into four (4) sections, corresponding to Exams 1, 2, 3, and the Post-Exam 3 material. You can replace your LOWEST EXAM SCORE ONLY with the score earned on the corresponding section from the final. This exchange is only made if it benefits you and will not be made in cases where the hour exam was missed resulting in a zero (0).

Makeup Exams: There will be NO MAKEUP EXAMS. The only exception to this policy is in the case of an official request from the Dean of Students. Common issues of which that the Dean should be made aware are a death or serious illness in the immediate family, hospitalization, special care from a mental health professional, and death or serious illness of a dorm- or house-mate.

Final grades will be determined by first determining the % of possible points obtained on each of the 6 items above. Final letter grades will be given based on the following scale:
A (100 - 80); B (79 - 70); C (69 - 60); D (59 - 50); F (below 50).

Pre-Lab Questions: The course Tsquare site contains the Pre-Lab Questions. These MUST BE COMPLETED BEFORE PERFORMING THE ASSOCIATED EXPERIMENT. Failure to do so will result in a zero (0) for that particular question set, AND an automatic -10 points on the associated lab report.
Laboratory Rules and Policies:
1. **You must supply your own 100% cotton lab coat and goggles.** Gloves are provided
2. **If you arrive to lab more than 10 minutes late,** you will not be allowed in the lab and will receive a zero for that particular experiment.
3. **All excused absences and deadline extensions must be obtained in writing.** E-mail is preferred. Save the document or e-mail as confirmation. E-mail Dr. Jenson at david.jenson@chemistry.gatech.edu for an excused absence. This is for your benefit.
4. If you are given an excused absence, your work relating to that laboratory must be completed within **two weeks** of the missed assignment. This two-week period can be extended with the written permission of Dr. Jenson.
5. Concerning lab reports:
   a. **Lab reports are due at the beginning of your next regularly scheduled laboratory session.**
   b. If your do not complete your pre-lab, you will receive a zero for the pre-lab grade and have 10 points deducted from the corresponding laboratory report.
   c. All pre-labs are due Tuesday at 7:00 AM for all sections.
   d. You are advised to read the text references contained in the lab protocols.
   e. **You can only submit your lab report once.** Resubmissions are not allowed, even if you turned your report in before the due date.
   f. **This lab has a no late report policy;** however, all students are granted one 72 hour extension to be used at the student’s discretion. This single 72 hour extension can be used for any reason, without a grade penalty. If you turn in your report 1 minute late, you have used your extension.
   g. **You are required to check your e-mail for confirmation that your report has been submitted.**
   h. If you complete the lab, but fail to submit your report, you will receive 20 points as your grade for that experiment. Sanctions imposed by the Office of Student Integrity are exempt from this policy.
   i. **You MUST complete your calculations in the Excel cells.** You do NOT need to write sample calculations or equations. You can create a box to include sample calculations and equations, if you feel the need. If you do not use Excel for your calculations, you will receive no points for calculations. This applies even if the number in the cell is correct.
   j. **The use of Excel functions is sufficient for a calculation within the cell.** (For example: if you use the STDDEV function, you do not have to show the calculations for a standard deviation. The function will suffice.) There is one caveat: the function has to give the correct result. Commonly used functions like AVERAGE, SUM, STDDEV, STDDEVP, SLOPE, INTERCEPT and CORREL don’t cause problems when applied correctly.
k. Please not that there are different standard deviation functions in Excel. They are not equivalent. Their use is described below:
   i. STDDEV: Use this when the entire populations has been sampled. If you wanted to know the standard deviation of the mass of all of the quarters in your pocket, you can weigh them all. Since you have data for the entire set of quarters in your pocket, you should use STDDEV.
   ii. If you wanted to know the standard deviation of the mass of all the quarters in a large population, you could not weigh them all. You could weigh all of the quarters in your pocket and determine the standard deviation, but you would not have the data for the entire set of quarters. In this case, you should use STDDEV.
   iii. STDDEV and STDDEV converge as the population approaches infinity.
   iv. In experiment 1, the pellets you will be assigned are a sample of a much larger population of pellets.

l. Please do not alter, in any way, the orientation of the colored boxes in the data tab. These cells need to be in a specific orientation for grading purposes. If you need additional cells for intermediate calculations, please include them to the right of the colored cells.

m. If you would like to add units to a column or row heading, you may do so. For example Cell B12 in the Experiment 1 template can be changed from “Mass of Black Pellets” to “Mass of Black Pellets (g)”.

n. Do not include units in the cells containing data. Enter 2.1123 into the cell, not 2.1123 g.

o. The templates have tabs for your abstract and questions. Do not submit your abstract and questions as additional attachments.

p. You need to write your experimental data in your notebooks as you acquire the data.

q. You can use the Q-test to discard one outlier.

r. You are allowed one test titration at the beginning of each lab to determine your approximate endpoint. You are permitted to do this for all titrations. I would suggest adding 0.5-1.0 mL at a time until you pass the endpoint. Do not include this data in your lab report, but include it in your notebook. Before you do a test titration, you need to clearly indicate in your lab notebook the intention to do so.

s. You do not keep results when there is obvious error. An example: If you are halfway through a titration and your stopcock begins to leak, don’t record the data. In fact don’t even finish the titration. Another example: If you clearly overshoot the endpoint (i.e. the stopcock jammed), you don’t report the data. This does not mean that you can use the data if it makes your results “better.” If you are discarding data due to obvious error, you need to note that immediately in your lab book. You can’t wait until the end of lab to decide to keep or discard the data.

6. General lab safety and conduct:
   a. Please keep the balance area clean. Brushes are provided for that purpose.
   b. Clean your glassware at the end of lab. This is a shared glassware laboratory. If your do not keep your glassware clean as a group, your grades will suffer as a group.
c. In light of 2b, you will receive a 10 point reduction on your lab report if you do not clean your bench at the end of the lab period. This includes dirty labware, leaving solutions of the bench top, and not cleaning the balance area.

d. DO NOT kneel or stand on stools. Step stools are provided for your convenience. If you can't read your buret, then lower it over the side of the counter. Anyone caught kneeling or standing on a stool will be dismissed from the lab for the day and assigned a zero for the assignment.

e. There should be no skin visible below the neck, with the exception of your arms (from mid-bicep down). This means you must wear socks that will cover your ankles. Your sleeves must be at least 4 inches long, as measured from the hem. You need to be appropriately dressed for lab before you put your lab coat on.

f. Many reagents will be stored in the desiccator. Remove the sample from the desiccator for as little time as possible. Do not leave the desiccator open. To open the desiccator, you will need to slide the lid horizontally. Trying to lift the lid vertically will not be effective.

**The Structure of a Lab Report:**
You will be provided with “templates” in MS Excel that guide you through the correct structure of a lab report in CHEM 2211. In general, you should have all written lab reports multiple times in prerequisites for this course. Briefly, the following describes the desired structure of a lab report. More detail is available on Tsquare under the “Laboratory Information, Protocols and Excel Templates” link.

**Abstract:** The abstract should describe what experiments were done and (briefly), the results and conclusions of those experiments.

**Data/Results:** Your data should be neatly organized, and should be identical to what was written in your notebook (in terms of the numerical values). Statistical analyses of the data should be grouped together with the appropriate data set. Typically, many plots and graphs are required to make the data understandable and to present the data in the clearest manner possible. Make sure that your graphs are neat, organized, and labeled properly.

**Questions:** Each report is followed by questions that you may have to look beyond the textbook to answer. Please answer these carefully.
### Course Schedule:

<table>
<thead>
<tr>
<th>Week of</th>
<th>Lecture Topic</th>
<th>Experiment</th>
<th>HW (note: chapters correspond to 8th edition)</th>
<th>Exams</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 20</td>
<td>Intro/Error Analysis</td>
<td>No Labs</td>
<td>Ch. 0, 1, 3, 4</td>
<td></td>
</tr>
<tr>
<td>August 27</td>
<td>Equilibria</td>
<td>1-Intro to the Analytical Balance</td>
<td>Ch. 6, 8, 10</td>
<td></td>
</tr>
<tr>
<td>September 3</td>
<td>Polymer Characterization</td>
<td>2-Standardization of NaOH Reagent</td>
<td>Ch. 7</td>
<td>Exam 1 – Sept. 21st</td>
</tr>
<tr>
<td>September 10</td>
<td>Multiple Equilibria</td>
<td>3-Molecular Weight of a Polymer</td>
<td>Ch. 9</td>
<td></td>
</tr>
<tr>
<td>September 17</td>
<td>Gravimetry and Colloids</td>
<td>4-Determination of a Polyprotic Acid</td>
<td>Ch. 26</td>
<td>Exam 1 – Sept. 21st</td>
</tr>
<tr>
<td>September 24</td>
<td>Metal Ion Analysis</td>
<td>5-Gravimetric Determination of Nickel</td>
<td>Ch. 11, 12</td>
<td></td>
</tr>
<tr>
<td>October 1</td>
<td>Redox Equilibria</td>
<td>6-Complexometric Titration of Zinc with EDTA</td>
<td>Ch. 13, 14, 15</td>
<td></td>
</tr>
<tr>
<td>October 8</td>
<td>Spectroscopic Analysis</td>
<td>7-Potentiometric Titration of Ferrocyanide</td>
<td>Ch. 17</td>
<td></td>
</tr>
<tr>
<td>October 15</td>
<td>Spectroscopic Analysis</td>
<td>No Labs – Fall Recess</td>
<td>Ch. 18</td>
<td>Exam 2 – Oct. 19th</td>
</tr>
<tr>
<td>October 22</td>
<td>Protein-Ligand Interactions</td>
<td>8-Spectrophotometric Analysis of a Complex Mixture</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>October 29</td>
<td>Separations</td>
<td>9-Spectroscopic Analysis of Protein-Ligand Binding</td>
<td>Ch. 22</td>
<td></td>
</tr>
<tr>
<td>November 5</td>
<td>Chromatography</td>
<td>10-Extraction of a Zinc Complex</td>
<td>None</td>
<td>Exam 3 – Nov. 19th</td>
</tr>
<tr>
<td>November 12</td>
<td>Chromatography</td>
<td>11-Separation of Textile Dyes by Electrophoresis</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>November 19</td>
<td>Special Topics</td>
<td>No Labs – Thanksgiving Break</td>
<td>None</td>
<td>Exam 3 – Nov. 19th</td>
</tr>
<tr>
<td>November 26</td>
<td>Special Topics</td>
<td>Laboratory Practicum</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>December 3</td>
<td>Review</td>
<td>Dead Week</td>
<td>Dead Week</td>
<td>Dead Week</td>
</tr>
<tr>
<td>December 10</td>
<td>FINALS</td>
<td>FINALS</td>
<td>FINALS</td>
<td>Final Exam Date/Time TBA (Cumulative, including Chromatography and Special Topics)</td>
</tr>
</tbody>
</table>
**Homework:** Homework and in-class problem sets will be run through Sapling Learning online. Below are the instructions on how to set up an account and gain access to the site. The price is $29.99 for the semester.

2. If you already have a Sapling Learning account, log in, then skip to step 5.
3. If you have a Facebook account, you can use it to quickly create a Sapling Learning account. Click "create account" located under the username box, then click "Login with Facebook". The form will auto-fill with information from your Facebook account (you may need to log into Facebook in the popup window first). Choose a password and fill in the remaining information, accept the site policy agreement, and click "Create my new account". You can then skip to step 5.
4. Otherwise, click "create account" located under the username box. Supply the requested information and click "Create my new account". Check your email (and spam inbox) for a message from Sapling Learning and click on the link provided in that email to confirm your account.
5. Find your course in the expandable list (sorted by subject, term, and instructor) and click the title link.
6. Select your payment options and follow the remaining instructions.

Once you have registered and enrolled, you can log in at any time to complete or review your homework assignments. During sign up - and throughout the term - if you have any technical problems or grading issues, send an email to support@saplinglearning.com explaining the issue. The Sapling support team is almost always more able (and more quick) to resolve issues than...

All of the homework is online. There are 18 homework assignments, although the first few should be mainly review from previous coursework. Due dates are listed on the Sapling site. Please note that the first few review sets are ALL due during the first week of classes. Grading policies are available on the Sapling site.


You are expected to read each of these Codes on your own; all students are expected to adhere to these Codes and all violations will be dealt with through the Dean of Students. Furthermore, plagiarism will not be tolerated in this class. Plagiarizing is defined by Webster’s as “to steal and pass off (the ideas or words of another) as one’s own: use (another’s production) without crediting the source.” If caught plagiarizing, you will be dealt with according to the GT Academic Honor Code by the office of the Dean of Students.

Some helpful guidelines: (1) Quote and attribute any words that are not your own. (2) Do not cut and paste ANYTHING into your papers. (3) Do not use "word." (With "word" being any material a student may have acquired from a previous semester of your class.)
Safety Rules

Please remember that any chemical laboratory can be a hazardous place. Read carefully this safety sheet, then sign and date it. Observe these rules at all times in the laboratory.

1. **Wearing of approved safety eyewear in the laboratory is absolutely mandatory!** You will be asked to leave the lab and obtain safety eyewear if you are found without it. There will be no exceptions to this rule. Approved eyewear means eye covering which will protect against both impact and splashes. **Even those students who wear glasses must wear safety eyewear.**

2. 100% cotton lab coats must be worn at all times.

3. **Music is not permitted in the laboratory.** This includes music played from a stereo or computer, as well as portable music players.

4. You must dispose of waste chemicals in appropriate, labeled receptacles provided for that purpose. If in doubt, ask your TA or laboratory instructor about the procedure for safe chemical disposal. These containers must remain capped when waste is not being added to them.

5. If any chemical is spilled on you, rinse the affected area for at least 15 minutes with cold water and notify your TA or laboratory instructor.

6. **DO NOT kneel or stand on stools.** Step stools are provided for your convenience. If you can’t read your buret, then lower it over the side of the counter. **Anyone caught kneeling or standing on a stool will be dismissed from the lab for the day and assigned a zero for the assignment.**

7. **There should be no skin visible below the neck, with the exception of your arms (from mid-bicep down).** This means you must wear **socks** that will cover your **ankles.** You need to be appropriately dressed for lab before you put your lab coat on.

8. No running or horseplay in the laboratory.


10. Do not taste anything in the laboratory or put anything into your mouth. Food and drinks of any kind are prohibited in the laboratory. Do not eat or drink from laboratory glassware.

11. In case of fire or accident, notify the laboratory instructor or TA at once. **Note the location of fire extinguishers, eye wash stations and safety showers in the laboratory in case you need to use them.**

12. **PANTS must be worn.** Tights are not allowed. No shorts or skirts. Your ankles must not be exposed.

13. **No tank tops, halter tops or tube tops are allowed in the laboratory.**

14. No sandals or open shoes are to be worn in the lab. Shoes must be closed-toe and closed-heel. Shoes must be constructed so that the heel is no more than one inch from the ground.

15. Confine long hair when in the lab.

16. Neckties are not allowed in the laboratory.

17. You may not perform any unauthorized experiments.

18. Always secure vacuum flasks with a clamp when in use.

19. Never pipet a reagent by mouth. Always use the pipeting bulb provided.

20. **Note the odor of chemical fumes in the lab. Avoid breathing fumes of any kind.**

21. Ask you TA or laboratory instructor, if in doubt about the safety of any chemical, equipment or procedure.

22. Students are required to follow Georgia Tech’s Personal Protective Equipment policy at all times.

I have read the above rules and will observe them in the laboratory.

Print Name: ____________________________

Signature: ____________________________ Date: ________________