

**Syllabus** (Fall 2015)

**CHEM 2211 – Quantitative Analysis**

**Catalog Description:** Quantitative Analysis laboratory experimentation emphasizing quantitative chemical analysis.

**Pre-requisites:** CHEM 1312 (Minimum Grade of D) or CHEM 1212K (Minimum Grade of D)

**Instructor:** Prof. Ronghu Wu  
Office: EBB1 4011  
Phone: 404-385-1515  
Email: Ronghu.wu@chemistry.gatech.edu  
***Note:** When emailing me, please set the subject of your message to: **CHEM 2211**. This will help me to answer promptly.*  
**Office Hours:** MF 11:00 AM – 12:30PM or by appointment

**Laboratory Coordinator:** Dr. Christy O'Mahony  
Office: Boggs 2-90E  
Phone: 404-894-2843  
Email: christy.o'mahony@chemistry.gatech.edu  
**Office Hours:** By appointment only

**Teaching Assistants:** Dedra Eichstedt  
Po-Yu (Paul), Fang  
Giang Nguyen  
**Office Hours:** T,W,Th 1:00 PM – 2:00 PM in Boggs Room 2-88

**Lecture & Recitation:** MWF: 10:05 - 10:55 am (Instr Center 117); attendance is required

**Laboratories:** Tuesday, Thursday or Friday 2:05 – 5:55 pm, Boggs room 2-66 and 2-72

**Required Text:** Quantitative Chemical Analysis, 8th Edition by Daniel C. Harris (hardcopy or online version)

## Required On-Line Content:

#1: T-square site for this course: <https://t-square.gatech.edu/portal>

#2: Electronic Homework:

1. Go to <http://saplinglearning.com>
2.
  - a). If you already have a Sapling Learning account, log in, click "View Available Courses", then skip to step 3.
  - b). If you have Facebook account, you can use it to quickly create a SaplingLearning 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 timezone, accept the site policy agreement, and click "Create my new account". You can then skip to step 3.
  - c). Otherwise, click "create account" located under the username box. Supply the requested information and click "Create my new account". Check your email (and spam filter) for a message from Sapling Learning and click on the link provided in that email.
3. Find your course in the list (listed by school, course, and instructor) and click the link.
4. Select your payment options and follow the remaining instructions.
5. Once you have registered and enrolled, you can log in at any time to complete or review your homework assignments.
6. During sign up - and throughout the term - if you have any technical problems or grading issues, send an email to [support@saplinglearning.com](mailto:support@saplinglearning.com) explaining the issue. The Sapling support team is almost always more able (and faster) to resolve issues than your instructor.

## Learning Objectives:

- Provide students with the theoretical underpinnings of modern methods of chemical analysis
- Enhance their understanding of the applications and limitations of wet chemistry techniques in analysis
- Provide students with experience in applying the method of simultaneous equations to solve complex equilibrium problems
- Promote an introductory level understanding of the applications of sampling, statistics, separation, and analysis in determining the composition of chemical mixtures

**Topical Outline:**

- Basic Statistics
- Acid-Base Titrimetry
- Gravimetric Methods of Analysis
- Complexometric Titrations
- Potentiometry
- Analytical Spectroscopy
- Fundamentals of Extraction
- Electrophoresis

**List of Experiments**

Expt 1: Introduction to the Analytical Balance

Expt 2: Standardization of Sodium Hydroxide Reagent

Expt 3: Molecular Weight of a Polymer

Expt 4: Polyprotic Acid Titration

Expt 5: Gravimetric Determination of Nickel

Expt 6: Complexometric Titration of Zinc with EDTA

Expt 7: Potentiometric Titration of Iron(II)

Expt 8: Spectrophotometric Analysis of a Complex Mixture

Expt 9: Determination of Glucose

Expt 10: Extraction of a Zinc Complex

Expt 11: Separation of Textile Dyes by Electrophoresis

Laboratory Practicum: Determination of Water Hardness by Complexometric Titration

## Assessment

The course grade will equally weight the student's performance in lab and lecture. A passing grade in both lab and lecture is required. Final grades will be given based on the following scale:

A (100 – 80%)

B (79 – 70%)

C (69-60%)

D (59-50%)

F (below 50%)

Student performance in lecture will be evaluated by:

- a. Electronic homework (10%)
- b. Attendance, class participation and quiz (15%)
- c. Three “midterm” exams (15% each) given on **September 21<sup>st</sup>**, **October 16<sup>th</sup>**, and **November 13<sup>th</sup>**.
- d. Cumulative final exam (30%) on **December 7** (Monday) from 11:30am - 2:20pm

Student performance in laboratory will be evaluated by:

- a. Ten pre-lab question sets (10%)
- b. Ten laboratory reports (70%)
- c. Lab practicum (20%)

**Makeup Exams:** Makeup exams will only be administered to students who missed the exam because of a school-sponsored event or present an official request issued by the Dean of Students. The Dean of Students will issue a request following 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. Appropriate documentation will be required.

## General Information and Policies:

- Attendance at lecture is **required**. Lectures will be devoted to the general theoretical and practical aspects of the analytical procedures encountered in the laboratory.
- The student **MUST** read the relevant material in the text before each lab. The student is also expected to have carefully read the lab procedure before his or her lab period.
- The student **MUST** have completed the on-line **Pre-Lab Questions**. These are due by **Tuesday @ 7am**. Students who miss this deadline will have points deducted from their report grade.
- Students must be on time for each lab meeting, since the laboratories are tightly scheduled and there is very little free time available. **The lab will not be open at hours other than those scheduled.** Students may not under any circumstances work in the laboratory without supervision.
- **Wearing safety eyewear, lab coats, and shoes in the laboratory is absolutely mandatory! You will be asked to leave the lab and obtain safety eyewear if you are found without it.**
- Each student is required to keep and maintain the equipment in working order. A computer is available for each student to record data, compute the results and submit them electronically. **Instructions for each laboratory experiment are available on-line at T-Square: <https://t-square.gatech.edu/portal>**
- Each laboratory report will be due via upload to T-Square by **2 pm on your lab day of the week following the laboratory**. **No late submissions will be allowed.** (There are a few exceptions to this which will be discussed in laboratory.)
- Prior to beginning laboratory work each student must:
  1. Maintain a \$50 balance on your Buzz Card for replacement of lost or broken lab equipment.
  2. Claim their laboratory drawer and put their name on it.
  3. Purchase a laboratory notebook from the bookstore (**with carbon copy pages**).
  4. Sign and date two copies of the Safety Notes page, retaining one copy for your records.

Prior to receiving grade (or withdrawing from this course) each student must check out of the laboratory drawer and replace all missing or broken equipment. Failure to do so will result in a grade of "F" being issued until students are in compliance with this policy. **NOTE: This is a NO-DROP course and may be dropped only by permit.**

## **The Structure of a Lab Report:**

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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 T-Square under the “Laboratory Information” link.

**Abstract:** The abstract should describe what experiments were done and the results and conclusions of those experiments (limit to ~200 words).

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**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. You should always include any equations used in your analyses, and sample calculations should be included when multi-step calculations are performed. Check with your TA to see if sample calculations are required for particular writeups, if you are not sure. 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 (axis, legends etc.).

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

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**Suggested Problems from *Harris*:**

**Chapter 0:** 1, 5, 6

**Chapter 1:** 14, 20, 26

**Chapter 3:** 5, 12, 16

**Chapter 4:** 13, 14, 19, 21

**Chapter 6:** 4, 12, 17, 36, 39, 49

**Chapter 7:** 9, 11, 16, 24

**Chapter 8:** 17, 19, 22, 24

**Chapter 9:** 3, 5, 7, 20, 23, 27, 32, 34, 39

**Chapter 10:** 4, 10, 14, 18, 23,

**Chapter 11:** 4, 8, 14, 23, 31,

**Chapter 13:** 3, 6, 9, 31, 32, 34

**Chapter 14:** 6, 11, 13, 16, 18, 25,

**Chapter 15:** 1, 6, 9

**Chapter 16:** 2, 3, 5

**Chapter 18:** 9, 10, 12, 16, 19, 23

**Chapter 23:** 2, 7, 10, 13, 15, 27, 29, 40

**Chapter 27:** 10, 13, 17, 21

## **The Honor Code and Plagiarism**

The Academic Honor Code can be found at:

<http://www.osi.gatech.edu/plugins/content/index.php?id=46>

Students are expected to read this code and abide by it. Please note that plagiarism will not be tolerated. 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." You are strongly encouraged to: (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.) (4) Submit the data that you acquired in lab, not data acquired by others. Students suspected of academic misconduct will be referred to the Office of Student Integrity for adjudication.