Course Syllabus  
Spring 2011  
Chemistry 231  
Quantitative Analysis

Course Description: Analytical applications of solution chemistry.

Number of Credit Hours: 4 semester hours - 3 hours lecture  
Course Prerequisites and Corequisites: Prerequisite: CHE 134 and 134L. Lab fee required.

Program Learning Outcomes:  
1. The student will demonstrate knowledge of fundamental content in the basic areas of chemistry: Analytical, Biochemistry, Inorganic, Organic, and Physical.  
2. The student will integrate knowledge with critical thinking to solve problems.

General Education Core Curriculum Objectives: There are no specific general education core curriculum objectives in this course. This course is not a general education core curriculum course.

Course Objective: To provide students with a more detailed explanation of the basic concepts, laws, and theories of some of the topics discussed in General Chemistry and to apply the knowledge to chemistry problem solving at an advanced level. The student will develop an appreciation for chemistry as it relates to the other disciplines. Furthermore, the student will recognize how chemistry provides solutions to contemporary, historical, technological, and societal issues.

Student Learning Outcomes: The student is expected to recognize and apply the fundamental and practical aspects of the following concepts and apply the concepts to problem solving:  
- units of measure, unit conversions, density, and definitions of matter (PLO 1)  
- introduction to the analysis of real samples and the difficulties involved in handling real samples such as sampling, preparation, decomposition, dissolution, and the elimination of interferences (PLO 1)  
- principles of experimental error in chemical analysis including the sources of experimental errors and the application of statistics to data treatment and evaluation using spreadsheets (PLO 1, 2)  
- concept of gravimetric analysis including experimental aspects of this type of analysis and the use of gravimetric factor in calculations (PLO 1, 2)  
- principles of titrimetric methods of analysis, with emphasis on dilution of solutions, the theory of neutralization, titration curves for complex acid/base systems, precipitation titrimetry, oxidation/reduction titrations, potentiometric titrations, and complex-formation titrations (PLO 1, 2)  
- properties of aqueous solutions, including activity of ions, application of the Debye-Huckel equation to thermodynamic equilibrium constant (PLO 1, 2)  
- concept of equilibrium as it applies to complex systems and chemical analysis,  
- principles of electrochemistry including standard electrode potentials, the Nernst equation, and the theory of potentiometry, electrogravimetry, coulometry, voltammetry (PLO 1, 2)  
- basic principles of spectrochemical methods of analysis, with emphasis on ultraviolet and visible absorption spectroscopy, atomic absorption spectroscopy, and the application of Beer’s Law in problem solving and analysis (PLO 1, 2)
• concepts of chromatography with the main emphasis on liquid and gas chromatography, response factors, and as time permits, the van Deemter equation (PLO 1, 2)

Outline of Topics (approximate course time):
• Introduction to Analytical Chemistry (5-15%)
• Errors and Statistical Data Treatment in Chemical Analysis (5-15%)
• Sampling, Standardization, and Calibration (5-15%)
• Aqueous Solutions and Chemical Equilibria (5-15%)
• Effects of Electrolytes on Chemical Equilibria (5-15%)
• Solving Equilibrium Calculations for Complex Systems (5-15%)
• Gravimetric Analysis (5-15%)
• Titrimetric Methods (5-15%)
• Neutralization Titrations (5-15%)
• Titration Curves (5-15%)
• Complexation Reactions and Titrations (5-15%)
• Electrochemistry (5-15%)
• Potentiometry and Voltammetry (5-15%)
• Spectroscopy (5-15%)
• Chromatography (5-15%)
Class Syllabus
Spring 2012
Quantitative Analysis (CHE 231-001)

Professor: Dr. Darrell R. Fry
Office: NM. Rm. 120
Phone: 936-468-1406
Office Hours: MW 8:30-12; TR 9:30-11:50 and by appointment
Lecture times: TR 8:00-9:15 a.m. in Rm. NM 132

CATALOG DESCRIPTION: Quantitative Analysis – 4 semester hours, 3 hours lecture, 3 hours per week. Analytical applications of solution chemistry. Lab fee required.

PREREQUISITES: A grade of C in both CHE 133 and CHE 134. Co-requisite: CHE 231L.

REQUIRED TEXTS AND OTHER MATERIALS:
- Access to Sapling Learning. See the last page of the syllabus for instructions.
- Scientific Calculator

REQUIRED SUPPLEMENTARY READINGS:
- Any freshman chemistry text such as Chemistry the Central Science any edition by Brown, LeMay and others.

Please note, these texts are on reserve in Library under Fry. Specifics concerning page numbers and dates will be announced in class as necessary. Other supplementary readings may be required as the semester progresses. Of course, these will be announced in class.

COURSE OBJECTIVES: The student will learn more about the basic concepts, laws, and theories of some of the topics discussed in General Chemistry and will be able to apply the knowledge to chemistry problem solving at an advanced level. The student will develop an appreciation for chemistry as it relates to the other disciplines. Furthermore, the student will earn how chemistry provides solutions to contemporary, historical, technological, and societal issues.

ATTENDANCE POLICY:
Attendance of class is mandatory. A student with four or more excused absences will result in an "F" for the course. Moreover, coming to class on time is required. A tardy counts as ½ of a absences. Thus, 8 tardies will result in an “F” for the course.

ACADEMIC HONESTY POLICY: Any student found cheating will be subject to the penalties as stated in the Student Code of Conduct handbook; including but not limited to a score of zero on exam, expulsion from the class or expulsion from the University. Academic misconduct includes plagiarism, copying answers from friends, copying solution manual answers that you claim to be your own. ([http://www.sfasu.edu/upp/pap/academic_affairs.html](http://www.sfasu.edu/upp/pap/academic_affairs.html)).
Examples of academic dishonesty include:
- Exchanging answers or information during a test or quiz
- Looking at another student’s paper during a test or quiz
- Bringing or looking at a book or other unauthorized source during the quiz or test
- If caught cheating a zero will be given to the cheater and or both students colluding in cheating.

Other steps will be taken as stated in [http://www.sfasu.edu/upp/pap/academic_affairs.html](http://www.sfasu.edu/upp/pap/academic_affairs.html)

Students engaging in any type of academic misconduct (including, but not limited to: cheating, plagiarism, or any other action that can improperly affect my evaluation of your performance) will be subject to sanctions in accordance with SFA Academic Integrity Policies. Please note: The usage of electronic devices (including, but not limited to: cell phones, PDAs, mp3 players, etc.) while a quiz or exam is being given will be treated as academic misconduct. DO NOT HAVE THESE DEVICES OUT DURING A QUIZ OR AN EXAM! I will recommend a grade of "F" for the course.

**SEMESTER WITHDRAWALS:** Last day to withdraw from the course without obtaining WP or WF grade is Wednesday, March 21st 2012.

**ACADEMIC DISABILITIES POLICY:** Students with Disabilities – To obtain disability – related accommodations and/or auxiliary aids, students with disabilities must contact the Office of Disability Services, Human Services Building, Room 325, 468-3004/468-1004 (TDD) as early as possible in the semester. Once verified, DS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided.

**CLASSROOM BEHAVIOR POLICY:** To ensure a classroom environment conducive to learning, any forms of classroom disruptions will not be tolerated (examples but not limited to – talking, use of cell phones/beepers, sleeping, reading other material, eating/drinking). Students who violate these rules will be asked to leave. Repeat offenders will be subject to disciplinary action in accordance with University policies as described in the Code of Student Conduct.

**Note:** If you are taking this course in preparation for the TEKS (to become a teacher) you need to contact [Dr. John Moore](mailto:john.moore@sfasu.edu) in NM 117 (the Chemistry Building).
**STUDENT LEARNING OUTCOMES:** The student is expected to learn and apply the fundamental and practical aspects of the following, and master the following concepts to problem solving:

1. Units of measure, unit conversions, density, and definitions of matter.
2. Introduction to the analysis of real samples and difficulties involved in handling real samples such as sampling, preparation, decomposition, dissolution, and elimination of interferences.
3. Principles of experimental error in chemical analysis including the sources of experimental errors and the application of statistics to data treatment and evaluation using spreadsheets.
4. Concepts of gravimetric analysis including experimental aspects of this type of analysis and the use of gravimetric factor in calculations.
5. Principles of titrimetric methods of analysis, with emphasis on dilution of solutions, the theory of neutralization, titration curves for complex acid/base systems, precipitation titrimetry, oxidation/reduction titrations, potentiometric titrations, and complex-formation titrations.
6. Properties of aqueous solutions, including activity of ions, application of the Debye-Hückel equation to thermodynamic equilibrium constants.
7. Concepts of equilibrium as it applies to complex systems and chemical analysis.
8. Principles of electrochemistry including standard electrode potentials, the Nernst equation, and the theory of potentiometry, electrogravimetry, coulometry, voltammetry.
9. Basic principles of spectrochemical methods of analysis, with emphasis on ultraviolet and visible absorption spectrometry, atomic absorption spectroscopy, and the application of Beer’s Law in problem solving and analysis.
10. Concepts of chromatography with the main emphasis on liquid and gas chromatography, response factors, and as time permits, the Van Deemter Equation.

**COURSE CONTENT:** Chapters from the text will be covered with more emphasis on some chapters than others. Given below is tentative information about what will be on each exam. Please note that exam dates are fixed, but the material on the exam is not. The material will mold around the exam dates.

<table>
<thead>
<tr>
<th>Exam</th>
<th>Chapters</th>
<th>Ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1</td>
<td>0, 3, 4, 5</td>
<td>the analytical process: experimental error, statistics, quality assurance and calibration methods</td>
</tr>
<tr>
<td>Exam 2</td>
<td>7, 8, 9, 10</td>
<td>Equilibria: activity and systematic treatment, Acid-Base Equilibria, Acid-Base Titrations</td>
</tr>
<tr>
<td>Exam 3</td>
<td>13, 14, 15, 16</td>
<td>electrochemistry: electrodes and potentiometry, redox titrations and Electroanalytical techniques</td>
</tr>
<tr>
<td>Exam 4</td>
<td>17, 18, 19, 20, 21</td>
<td>Applications of spectrometry, spectrophotometers, atomic spectrum and mass spectrum</td>
</tr>
<tr>
<td>After exam 4 and before the final</td>
<td>22, 23, 24</td>
<td>Separations: GC, LC</td>
</tr>
</tbody>
</table>
Grading Scheme:
Grades are based upon performance. The table below details the assessments used for the course. All of your course grades will be posted on blackboard throughout the semester.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Date(s)</th>
<th>Percentage of Course Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1</td>
<td>2/9</td>
<td>9%</td>
</tr>
<tr>
<td>Exam 2</td>
<td>3/1</td>
<td>10%</td>
</tr>
<tr>
<td>Exam 3</td>
<td>3/29</td>
<td>11%</td>
</tr>
<tr>
<td>Exam 4</td>
<td>4/19</td>
<td>12%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>5/8</td>
<td>20%</td>
</tr>
<tr>
<td>Pop Quizzes</td>
<td>Approximately weekly</td>
<td>8%--drop lowest few</td>
</tr>
<tr>
<td>Electronic Homework</td>
<td>Approximately weekly</td>
<td>5%--drop lowest few</td>
</tr>
<tr>
<td>Laboratory</td>
<td>See Lab Syllabus</td>
<td>25%</td>
</tr>
</tbody>
</table>

A 10% grading scheme will be used; thus 90-100% A; 80-89.5% B; 70-79.5% C; 60-69.5% D; less than 60% F. QFs will be given as appropriate.

Exams 1-4 will be given in the evening from 6.00 p.m - 8.00 p.m. in the Miller Science Building. All of these exams will be comprehensive including concepts from CHE 133 and CHE 134. These exams will consist of problems that must be set up and solved, discussion questions, and/or multiple choice, true/false, math problems, fill-in-blanks or essay type questions. Partial credit will be given for short answer problems worked partially correct; therefore, it is crucial to show your solutions to the problems, not just the answer. Students have one week from the day any graded item is returned to notify professor of grading error or ask questions about the grade of item. After one week no points will be returned. The professor has the prerogative of also re-grading the entire item. Credit will not be given for correct answers unless you show how you arrived at the answer. Multiple choice questions will have no partial credit.

In order for you to have enough time to complete exams, all exams (except for the final) will be given at night. It is your responsibility to make any needed adjustments in your class/work/extracurricular schedule to accommodate for this. Please keep in mind that 2 hours are allotted for the exams for a reason. You should expect exams that are thorough and challenging. Plan to stay for the entire two-hour period. Students arriving late will not be given extra time. Students who arrive more than 15 minutes late will not be allowed to take the exam. All students will be required to leave no later than 9:00pm. (Students may be required to leave prior to 9:00pm.)

Bonus points will be given on each of the exams for students who have shown excellent behavior. Behavior is not limited to perfect and punctual attendance but also includes paying attention in class and other positive behaviors.

No make-ups will be given for an exam regardless of the reason the exam was missed. Instead, the percentage score from the ACS standardized final will replace the missed exam. Please note, this means that the no curve will be applied to the missed exam.

The final exam will be a comprehensive, nationally-standardized exam developed by the American Chemical Society (ACS). The exam consists of multiple-choice questions, and is graded on a scantron (please bring scantron 882E to the final exam with you). The ACS final provides a national ranking for each individual student. Your national ranking will be used to compute your final exam score. The equation used in the past was: __________________________. In the past, students who scored in the 50th percentile made a 75% on the final exam. Those scoring in the 25th percentile made a 43.75%; those scoring in the 75th percentile made a 93.75%. More specifics about the
final will be given during dead week. Again, please note, those students who missed an exam will not receive this curve; instead they will have the percentage correct as the exam that they missed. Since the exam in a standardized national exam, there will be material that was not presented in class on the exam. Students should start worrying about the final exam the first day of the class; not at the end of the semester. Moreover, they should turn their worrying into study time. The final exam must be taken; students not taking the final will receive a grade of f (or qf if appropriate) regardless of the percentage total.

Periodic “Pop-Quizzes” will be given (approximately weekly). No make-ups (regardless of the reason) will be given for missed quizzes. Instead, the lowest few quizzes will be dropped. When the quizzes are given at the beginning of the class period, tardy students will not be allowed to take the quiz! Bring your calculator to class in order to use it on the quizzes.

Electronic homework from Sapling Learning will be used approximately weekly. No make-ups will be given for these assessments; instead the lowest few will be dropped.

A single grade will be given for the laboratory and the lecture. Since the laboratory will count 25% of the course grade with lecture comprising the other 75%. The specifics about the laboratory are given in the laboratory syllabus.

The syllabus (including the grading scheme) may be changed at the instructor’s prerogative. Changes will be posted on the Universities electronic website dedicated to the course (i.e. either Blackboard) and announced in class.
Sapling Learning

1. Go to http://saplinglearning.com
2a. If you already have a Sapling Learning account, log in, click "View Available Courses", then skip to step 3.
2b. 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.
2c. 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 option 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 faster) to resolve issues than your instructor.