SOUTHERN CONNECTICUT STATE UNIVERSITY
CHE 240 – Quantitative Analysis
Spring Semester, 2012
Tuesday, Thursday – 12:10 am – 5:00 pm

Name: Dr. Gregory S. Kowalczyk
Office: 330 Jennings Hall
Phone: 203-392-6268
E-mail: KowalczykG1@southernct.edu

Office Hours:
Monday and Wednesday: 2:00 – 3:00 pm
Tuesday: 10:00 am – 12:00 noon
Thursday: 11:00 am – 12:00 noon

Course number: CHE 240
Credit Hours: 4
Prerequisite(s): CHE 120-121
Course Title: Quantitative Analysis

COURSE DESCRIPTION:
Analysis of inorganic compounds by gravimetric, volumetric, electrometric and colorimetric methods.

COURSE CONTRIBUTION:
CHE 240 is a course that teaches the students quantitative methods of analysis where the emphasis is on “wet chemistry” including primarily gravimetric and volumetric methods of analysis. The course also introduces the students to colorimetric methods of analysis with one experiment requiring the use of a Spec 20. The course also teaches the students proper analytical laboratory techniques including use of the analytical balance, proper pipeting, filtration, decanting and titrating techniques.

The course emphasizes analytical thinking and problem solving. It also requires the students to plan their work prior to their arrival in lab. Solutions that are necessary for the experiment must be prepared from scratch by each student which means that the calculations must also be worked out individually. Students waiting to do these calculations when they get to lab, lose lab time that could be used for the experimental procedures.

The laboratory and lecture portions of the course are complimentary as laboratory experiments involve specific topics and techniques covered in lecture. Calculations required for the laboratory experiments are part of the theory presented in lecture.
LEARNER OUTCOMES & ASSESSMENTS: Link all course outcomes to NCATE, INTASC and CCCT standards

1. Collect data and apply information to solve chemical problems by identifying chemical relationships. (INTASC: 1,4, NSTA: 1, 2, 3, 5, CCCT: 1.3, 1.4)
2. Master lab techniques for accurate analytical determinations. (INTASC: 1,4, NSTA: 1, 2, 3, 5, CCCT: 1.3, 1.4)
3. Write appropriate equilibrium constant expressions for applicable chemical reactions (INTASC: 1, NSTA: 1, 2, 3, 5, CCCT: 1.2, 1.3, 1.4)
4. Understand the precipitation process and the chemical requirements for gravimetric analysis. (INTASC: 1, NSTA: 1, 2, 3, 5, 9, CCCT: 1.3, 1.4)
5. Know the difference between random and systematic errors. (INTASC: 1, 4, NSTA: 1, 2, 3, 5, CCCT: 1.3, 1.4)
6. Calculate $\alpha$-values for chemical species in an equilibrium system. (INTASC: 1, NSTA: 1, 2, 3, CCCT: 1.3, 1.4)
7. Perform equilibrium calculations based on mass and charge balance. (INTASC: 1, NSTA: 1, 2, 3, CCCT: 1.3, 1.4)
8. Learn when and how to make assumption in equilibrium calculations. (INTASC: 1, NSTA: 1, 2, 3, 4, CCCT: 1.3, 1.4)
9. Be able to select the proper indicator for volumetric determinations. (INTASC: 1, NSTA: 1, 2, 3, CCCT: 1.3, 1.4)
10. Identify standard types of reactions including redox, acid-base and precipitation. (INTASC: 1, NSTA: 1, 2, 3, CCCT: 1.3, 1.4)
11. Learn to manage lab time efficiently. (INTASC: 4, 5, 7, NSTA: 1, 3, 6, CCCT: 1.3, 1.4, 1.6, 2.5)

MODES OF LEARNING

The course is a combination of lecture and laboratory. The lecture portion of the course relies heavily on problem solving ability and analytical thinking. The laboratory portion of the course relies heavily on the lecture portion as experiments are designed to reinforce the theory discussed in lecture.

The laboratory portion of the course also teaches the student organization and time management techniques. Students need to prepare all of their own samples and solutions for each experiment. As a result, students need to prepare these calculations prior to arriving in lab in order to use lab time efficiently. The lab grade is based entirely on the analytical result of the experiment so the students must rely heavily on learning proper lab techniques.

<table>
<thead>
<tr>
<th>Expected Student Learning Activity</th>
<th>Weekly Hours for Course</th>
<th>Total Hours for Course (14-Week Semester)*</th>
<th>Term Credits Earned</th>
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<tbody>
<tr>
<td>Lecture Hours (Contact Time)</td>
<td>2</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Reading and Study Time</td>
<td>6</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>Assignments</td>
<td>4</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Lab Prep</td>
<td>3</td>
<td>42</td>
<td></td>
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<tr>
<td><strong>Total Hours</strong></td>
<td><strong>15</strong></td>
<td><strong>210</strong></td>
<td><strong>4</strong></td>
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* Please note that these times are only estimates based on the Department of Education’s definition of a credit hour and do not guarantee a specific grade in the course. Students may find that they require more or less time to succeed in the course.
## COURSE OUTLINE

<table>
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<tr>
<th>Weeks</th>
<th>Topic</th>
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</table>
| 1-3   | Gravimetric Analysis  
|       | Solubility Product  
|       | Activity Coefficients  
|       | Precipitation Processes, Methods  
|       | Contamination Mechanisms |
| 4-6   | Acid – Base Chemistry  
|       | Equilibrium Constants and Calculations  
|       | Derivation of $\alpha$-values and graphs  
|       | Polyprotic Systems  
|       | Indicator Selection  
|       | Endpoint Errors |
| 7-9   | Oxidation – Reduction Chemistry  
|       | Nernst Equation  
|       | $E_{\text{sys}}$ along a titration curve  
|       | Assumptions in the Nernst Equation  
|       | Selection of Indicators |
| 10-12 | Complexometric Chemistry  
|       | Complexing Agents - EDTA  
|       | $\alpha$-values as a function of pH  
|       | $pM$ calculations along a titration curve |
| 13-14 | Spectroscopic Analysis  
|       | Absorption of Light  
|       | Measuring Absorbance – Spec 20 Operations  
|       | Beer’s Law |
| 15    | Final Exam |

## REQUIRED TEXT(S)

COURSE REQUIREMENTS:

There are three hour exams and a cumulative final exam. In addition, there are graded homework assignments. In order to pass the course, the student must pass the course the laboratory. The passing grade for the laboratory is 60%.

Attendance: Regular and prompt attendance is expected.

Accommodating Students with Disabilities: If any student has a particular disability-related need in order to participate in this course, such as, special seating, note-taking assistance, use of tape recorders, or modified examination conditions, please let me know as soon as possible so that appropriate accommodations can be made.

Inclement Weather: When inclement weather threatens, call the university’s WeatherChek voice mail message line (203-392-SNOW) to hear the latest official information on possible delayed openings, class cancellations, or the closing of the university.

Some Final Thoughts: Unfortunately, the question of academic honesty occasionally becomes an issue between an instructor and a student. The best way to avoid this is to be sure that no suspicions arise. Cheating on exams or any phase of this course will not be tolerated. The student handbook outlines the various prerogatives of the instructor in cases of academic dishonesty.

EVALUATION CRITERIA

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Hour Exams</td>
<td>20%</td>
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<tr>
<td>Homework</td>
<td>10%</td>
</tr>
<tr>
<td>Laboratory</td>
<td>50%</td>
</tr>
<tr>
<td>Cumulative Final</td>
<td>20%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
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The following final grade schedule will be used:

A = 93 - 100%
A- = 90 - 92%
B+ = 87 - 89%
B = 83 - 86%
B- = 80 – 82%
C+ = 77 – 79%
C = 73 – 76%
C- = 70 – 72%
D+ = 67 – 69%
D = 63 – 66%
D- = 60 – 62%
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<tr>
<td><strong>S</strong> 1. Knowledge of subject matter 2. Knowledge of human development &amp; learning 3. Instruction adapted to meet diverse learners 4. Use of multiple instructional strategies &amp; resources</td>
<td>1. Content – Structure and interpret the concepts, ideas and relationships in science. 2. Nature of Science – Define the values, beliefs and assumptions inherent to the creation of scientific knowledge within the scientific community. 3. Inquiry – Formulating solvable problems, constructing knowledge from data, exchanging information for seeking solutions, developing relationships from empirical data. 4. Context of Science – Relate science to daily life: technological, personal, social and cultural values. 5. Skills of Teaching – Science teaching actions, strategies and methodologies, interaction with students, effective organization and use of technology. 6. Curriculum – Extended framework of goals, plans, materials and resources for instruction. 7. Social Context – Social and community support network, relationship of science to needs and values of the community, involvement of people in the teaching of science. 8. Assessment – Alignment of goals, instruction and outcomes, evaluation of student learning. 9. Environment for Learning – Physical spaces for learning, psychological and social environment, safety in science instruction. 10. Professional Practice – Knowledge and participation in the professional community, ethical behavior, high quality of science instruction, working with new colleagues as they enter the profession.</td>
<td><strong>DEMONSTRATIONS OF KNOWLEDGE</strong> 1.1 understanding of student learning &amp; development 1.2 understanding of need for different learning approaches 1.3 proficiency in reading, writing and mathematics 1.4 understanding of central concepts &amp; skills, tools of inquiry and structures of discipline(s) 1.5 knowledge of how to design and deliver instruction 1.6 recognition of need to vary instructional methods <strong>APPLICATION OF KNOWLEDGE THROUGH</strong> 2.1 instructional planning based upon knowledge of subject, students, curriculum &amp; community 2.2 selection and/or creation of learning tasks that make subject meaningful for students 2.3 establishment and maintenance of appropriate behavior standards and creation of positive learning environment 2.4 creation of instructional opportunities supporting students’ academic, social and personal development 2.5 use of verbal, nonverbal and media communication fostering individual and collaborative inquiry 2.6 employment of various instructional strategies in support of critical thinking, problem solving and skills demonstration 2.7 use of various assessment techniques to evaluate student learning &amp; modify instruction <strong>DEMONSTRATION OF PROFESSIONAL RESPONSIBILITY THROUGH:</strong> 3.1 professional conduct in accordance with the Code of Professional Responsibilities for Teachers 3.2 shared responsibility for student achievement and well-being 3.3 continuous self-evaluation regarding choices &amp; actions on students and school community 3.4 commitment to professional growth 3.5 leadership in the school community 3.6 demonstrations of a commitment to students and a passion for improving the profession.</td>
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TENTATIVE COURSE CALENDAR:

See Course Outline above.

BIBLIOGRAPHY


