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 and INTASC standards*

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

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.

Expected Student Learning Activity	**Weekly Hours for Course**	**Total Hours for Course (14-Week Semester)***	**Term Credits Earned**
Lecture Hours (Contact Time)	2	28	
Reading and Study Time	6	84	
Assignments	4	56	
Lab Prep	3	42	
Total Hours	**15**	**210**	**4**

* 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

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

REQUIRED TEXT(S)

Quantitative Chemical Analysis, 8th Ed., Daniel C. Harris, W. H. Freeman & Co., 2010.
Quantitative Analysis Laboratory Manual, G. Kowalczyk, 2003.

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

Hour Exams	20%
Homework	10%
Laboratory	50%
Cumulative Final	20%
Total	100%

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%

STANDARDS GUIDELINES

INTASC STANDARDS [Interstate New Teachers' Assessment & Support Consortium]	PROFESSIONAL STANDARDS National Science Teacher's Association
S 1. Knowledge of subject matter 2. Knowledge of human development & learning 3. Instruction adapted to meet diverse learners 4. Use of multiple instructional strategies & resources **A** 5. Effective learning environment created 6. Effective communication 7. Lesson planning **I** 9. Reflection and professional development **L** 8. Assessment of student learning to improve teaching **S** 10. Partnership with school and community	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.

TENTATIVE COURSE CALENDAR:

See Course Outline above.

BIBLIOGRAPHY

Quantitative Analytical Chemistry, J. S. Fritz and G. H. Schenk, Allyn and Bacon: Boston, 1969.

The Art and Science of Chemical Analysis, C. G. Enke, John Wiley & Sons, Inc.: New York, 2001.

Analytical Chemistry, G. D. Christian, John Wiley & Sons, Inc: New York, 2004.

Analytical Chemistry for Technicians, J. Kenkel, Lewis Publishers: Boca Raton, 2003.