COURSE ABBREVIATION  CHEM 1212
CREDIT HOURS  3 semester hours
COURSE TITLE  PRINCIPLES OF CHEMISTRY II
PREREQUISITES  MATH 1113, CHEM 1211, and CHEM 1211L, each with C or better
COREQUISITE  CHEM 1212L

CATALOG DESCRIPTION
Second course in a two-semester sequence covering the fundamental principles and applications of chemistry for science majors

EXPECTED EDUCATIONAL RESULTS
The student who has successfully completed the lecture course should be able to:
1. calculate solution concentration and colligative properties
2. understand the law of mass action and Le Chatelier's principle, and know how to solve problems involving equilibria for:
   weak acids and weak bases
   hydrolysis of salts
   buffers (common ion effect)
   solubility product
3. Apply principles of thermodynamics
   use Hess' Law to calculate the heats of reaction and formation
   use the Gibbs free energy to determine the spontaneity of a reaction
4. analyze reaction data and determine a rate law
5. define oxidation and reduction; balance redox equations
6. apply the acid-base theories

GENERAL EDUCATION OUTCOMES
I. This course addresses the general education outcome relating to communications as follows:
1. Students develop their reading comprehension skills by reading the text and handout materials.
2. Students develop their listening skills through lecture and small group problem solving. Lecture material is presented that is not included in the text or handout material and is included as part of the exams or test.
3. Students develop their reading and writing skills through the use of problems and activities developed specifically to enhance their understanding of certain principles. Students provide written or oral solutions to these problems in both individual and group format. They must also deal with short-answer type questions on course exams.

II. This course addresses the general education outcome relating to mathematical concept usage and applies the scientific method as follows.

1. Students must apply mathematical concepts in the solution of problems designed to illustrate the chemical principle being taught. Analysis of graphically presented material also test their mathematical skills as well as their ability to interpret and communicate qualitative data.

2. Students are required to graph data and perform appropriate mathematical operations for certain experiments.

III. This course addresses the general education outcome relating to demonstrating effective individual and group problem solving and critical thinking skills in a variety of situations as follows:

1. Students learn individual and group problem solving by doing problems both in classroom settings and at home.

2. Critical thinking skills are encouraged in many ways, one of which is by requesting student response to questions asked during the lecture.

IV. This course addresses the general education outcome relating to recognizing and applying scientific inquiry in a variety of settings as follows:

1. Students apply the scientific method in the set-up and solution of the problems designed to illustrate the chemical principle being taught.

2. Students use models that explain basic scientific method phenomenon and relate it to everyday situations.

3. Students use conceptual and physical models to explore theory and relate it to preexisting concepts.

### COURSE CONTENT

**Properties of Solutions**
- Colligative Properties
- Raoult's Law
- Concentration Units

**Chemical Equilibrium**
- The Condition of Chemical Equilibrium
- Le Chatelier's Principle
- Equilibrium Calculations

**Chemical Thermodynamics**
- The First Law of Thermodynamics
- Heats of Reaction and Formation
- Spontaneity, Entropy, and Free Energy
- Free Energy and Spontaneous Change

**Chemical Kinetics**
- Rates of Chemical Reactions
- Rate Laws
- Mechanisms

**Acids and Bases**
- Acid-Base Theories
- Neutralization Reactions and Titration Curves
- Strong Acids and Bases
- pH and pOH
- Weak Acids and Weak Bases
- the pH of salt solutions
- Common Ion Effect and Buffer Solutions
- Solubility product

**Electrochemistry**
ASSESSMENT OF EXPECTED EDUCATIONAL OUTCOMES

A. Course Grade
The course grade will be determined by the individual instructor (under the guidelines of the division) using a variety of methods such as quizzes, homework, group projects and exams. Graded activities are designed to measure students' abilities to use higher order thinking skills in their understanding and applying of chemical concepts. A comprehensive final exam is required. This exam must count for no more than 25% of the course grade.

B. Program Assessment
The General Chemistry Program (lecture and laboratory) will be assessed every 3 years in the fall and spring semesters. The committee will monitor the results of the assessment during non-assessment years and make curriculum revisions as necessary. For this program assessment.
   a. Key learning outcomes will be tested using an assessment tool such as the ACS examination for the lecture course
   b. The laboratory course will also be assessed in conjunction with the lecture course using either a standardized tool or one composed by the General Chemistry faculty which has been piloted in previous semesters.

C. Use of Assessment Findings
The Chemistry Curriculum Committee will analyze the assessment data. The committee will use assessment results to determine the effectiveness of the course by seeking answers to the following questions:
   1. Are students performing at a pre-determined minimal level of performance on:
      a. the course as a whole?
      b. on individual learning outcomes?
   2. Which learning outcomes are students' performance acceptable or above average?
   3. Which learning outcomes are student's performance below minimal level of performance?
   4. What factors are contributing to student performance on those learning outcomes below minimal level of performance?
   5. What changes or modifications in course content or instructional strategies are needed to help improve student performance on learning outcomes below minimal level of performance?

May 5, 2004