Miami Dade College

Course Competencies Template – Form 112

GENERAL INFORMATION	
Course Prefix/Number: CHM 2110C	Course Title: Survey of Quantitative Analysis
Number of Credits: 4 (2 hour lecture; 4 hour lab)	
Degree Type	☐ B.A. ☐ B.S. ☐ B.A.S ☒ A.A. ☒ A.S. ☐ A.A.S. ☐ C.C.C. ☒ A.T.C. ☐ V.C.C
Date Submitted: 10/12/06	Effective Year/Term: 2007-01
☒ New Course Competency ☐ Revised Course Competency	
Course Description (limit to 50 words or less): This course is a one-semester combination lecture-laboratory course covering the theories, calculations, and methodologies used in analytical chemistry. Topics include mathematical treatment of data; acid-base equilibria; and gravimetric, volumetric, and potentiometric methods of analysis.	
Prerequisite(s): CHM 1046 and CHM 1046L with a grade of "C" or better.	Corequisite(s): None

Course Competencies: (for further instruction/guidelines go to: http://www.mdc.edu/asa/curriculum.asp)

Competency 1: The student will demonstrate knowledge of statistical treatment of data by:

1. Applying statistical analysis to determine the validity and usefulness of experimental data.
2. Correctly reporting, treating, and manipulating analytical data.

Competency 2: The student will demonstrate knowledge of volumetric analysis by:

1. Comparing and contrasting analytical precision and accuracy.
2. Calculating concentrations.
3. Interconverting among concentration units.
4. Performing volumetric stoichiometric calculations.
5. Performing titration calculations (acid-base, reduction-oxidation, complexometric, precipitation).
6. Interpreting titration data and curves.
7. Plotting titration curves.
8. Selecting appropriate indicators that correctly signal the equivalence point in a titration.
9. Performing titrimetric / volumetric analyses (acid-base, reduction-oxidation, complexometric, and/or precipitation) via conventional, electrochemical, optical, and/or computer-interfaced methods.

Competency 3: The student will demonstrate knowledge of gravimetric analysis by:

1. Performing gravimetric stoichiometric calculations.

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2. Explaining those factors (nucleation, particle growth, digestion, adsorption, absorption) that influence and cause precipitation.
3. Performing gravimetric analyses.

Competency 4: The student will demonstrate knowledge of acid-base theory by:

1. Identifying properties and characteristics of acids, bases, salts, and buffers.
2. Explaining the use of buffers, buffering action, buffering capacity, buffer preparation, and the common-ion effect.
3. Demonstrating the relationship between acidity, alkalinity, neutrality, K_a, K_b, pK_a, and pK_b.

Competency 5: The student will demonstrate knowledge of mathematical treatment of equilibria by:

1. Predicting the outcome of acid-base equilibrium reactions.
2. Writing equilibrium expressions.
3. Manipulating equilibrium constants.
4. Identifying the characteristics of a dynamic equilibrium.
5. Calculating solubility products (K_{sp}).
6. Explaining the common-ion effect and its quantitative effect on equilibria.
7. Calculating the pH, pOH, $[H^+]$, and $[OH^-]$ of acids, bases, salts and buffers as a function of concentration.
8. Solving equilibria problems.
9. Calculating the equilibrium constant for weak acids (monoprotic and polyprotic) and weak bases (monobasic and polybasic).
10. Predicting how various factors affect equilibria using the Le-Châtelier's Principle.
11. Expressing the relationship that exists between E_o (standard cell potential) and the equilibrium constant.
12. Explaining the effect of ionic strength on the solubility of salts.
13. Using activity coefficients in equilibrium calculations.

Competency 6: The student will demonstrate knowledge of electrochemistry by:

1. Comparing and contrasting oxidation and reduction.
2. Identifying the components of oxidation-reduction reactions.
3. Balancing oxidation-reduction reactions.
4. Relating Coulombs to quantity of reaction.
5. Relating current to the rate of reaction.
6. Describing the components and functions of Galvanic cells.
7. Using cell / line notation to describe an electrochemical cell.
8. Calculating standard potentials from half-cell potentials.
9. Using the Nernst equation to solve electrochemical problems.

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10. Calculating electrical work.
11. Using standard electrochemical potentials to calculate equilibrium constants and standard Gibbs free energy.
12. Comparing and contrasting the use of various electrodes in potentiometry.
13. Describing standard electrode potentials, their measurement, and how electromotive force (EMF) is measured.
14. Describing the effect of concentration on electrode potentials.

Competency 7: The student will demonstrate knowledge of chromatographic separations by:

1. Explaining the main tenets of chromatographic analytical methods.
2. Explaining the instruments and techniques necessary for chromatographic analysis.
3. Explaining factors that affect chromatographic separation.
4. Analyzing and interpreting chromatograms.
5. Performing chromatographic analyses (high-pressure liquid, gas-liquid, column, paper, and/or thin-layer chromatography).

Competency 8: The student will demonstrate knowledge of spectrophotometric absorption and emission methods by:

1. Applying Beer's Law and explaining its limitations.
2. Comparing and contrasting various spectrophotometric analytical methods.
3. Describing procedures and instruments used in spectrophotometric analysis.
4. Performing spectrophotometric analyses.

Competency 9: The student will demonstrate knowledge of basic analytical laboratory skills and techniques by:

1. Using a spreadsheet as a means to manipulate quantitative information.
2. Using laboratory equipment (e.g., pipettes, burettes, volumetric flasks, analytical balances, pH meters, spectrophotometers, chromatographs) in a manner that achieves both accuracy and precision.
3. Preparing calibration / standard curves.
4. Preparing standard solutions.
5. Interpreting laboratory measurements and data, including SI units, significant figures, precision, and accuracy.
6. Identifying appropriate laboratory data collection procedures, techniques and equipment necessary to perform standard analytical laboratory activities.
7. Evaluating the design of chemical experiments.

Competency 10: The student will demonstrate knowledge of laboratory safety and good laboratory practices by:

1. Identifying and applying standard chemistry laboratory safety procedures.
2. Properly maintaining a scientific notebook.
3. Calibrating instruments.
4. Turning in required reports and successfully completing laboratory work in a timely fashion.

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