Prepared by the Department of Natural Sciences & Applied Technology
Date of Departmental Approval: February 15, 2017
Date Approved by Curriculum and Programs: February 22, 2017 Effective: Fall 2017

1. **Course Number: CHM106 and CHM106L**
   Course Title: Survey of Chemistry and Survey of Chemistry Laboratory

2. **Description:** Presents the fundamentals of chemistry that are integral to an understanding of physical and biological processes. Emphasis is placed on the relationships between these processes and contemporary environmental topics. For non-science majors. (3 class hours/ 2 laboratory hours).

3. **Student Learning Outcomes (instructional objectives; intellectual skills):**
   Upon successful completion of this course, students are able to do the following:
   - Define Chemistry and solve problems using the Scientific Method.
   - Measure in the Metric System to the proper number of significant digits and use these measurements to solve problems.
   - Describe matter (and energy) and classify substances in their correct categories.
   - Demonstrate knowledge of basic Atomic Theory by identifying atomic symbols and formulas and naming them.
   - Apply Atomic Theory to the transfer or sharing of electrons and to predict the bonding present in a molecule.
   - Balance chemical equations, classify chemical reactions and predict whether equations are spontaneous.
   - Count by weighing (using the Mole Concept), determine percent composition, calculate formulas from data.
   - Apply the Mole Concept to Stoichiometry problems, including percent yields and limiting reagents.
   - Relate Modern Atomic Theory to the Periodic Table.
   - Identify types of chemical bonds and apply electronegativity to predict polarity.
   - Explain Kinetic Molecular Theory and its relationship to the major Gas Laws.
   - Relate the Kinetic Molecular Theory to solids and liquids and use it compute various energy changes.
   - Describe solutions and predict solubility; calculate solution solubility in Mass Percent and Molarity.
   - Define acids, bases and acid strength.
   - Explain the pH scale and calculate the pH of strong acids and bases.
   - Define and identify a buffered system.
   - Use appropriate techniques in the laboratory, collect and analyze meaningful data, and present clearly and cogently written laboratory results (utilizing Standard American English).
   - Work cooperatively in a small group setting to complete various laboratory exercises, following the written instructions provided.
   - Solve problems that involve any of the topics included in the outline for this course.
   - Explain some of the ways in which Chemistry can be applied to the problems of society in
   - general.
   - Use a variety of devices and instruments in taking laboratory measurements.
   - Use a scientific calculator as a tool in solving a wide variety of problems.

4. **Credits:** Four credits

5. **Satisfies General Education Requirement:** Natural or Physical Science

6. **Prerequisite:** MAT020 (Prealgebra) or MAT025 (Pre-Algebra), ENL108 (Critical Reading & Thinking) or satisfactory basic skills assessment scores

7. **Semesters Offered:** Fall, Spring

8. **Suggested General Guidelines for Evaluation:** Course grading procedures and make-up policies are detailed in a student handout. In summary, 75% of the course grade evaluation is based on achievement in the lecture

portion of the course, while 25% is based on the laboratory portion of the course.

9. General Topical Outline:

CHM106 Survey of Chemistry - Course Outline

A. Chemistry: An Introduction
   1. What Chemistry Is
   2. Solving Problems Using the Scientific Approach
   3. The Scientific Method
   4. Observations, Theories and the Planets
   5. Learning Chemistry

B. Measurements and Calculations
   1. Scientific Notation
   2. Units
   3. Measurements of Length, Volume and Mass
   4. Uncertainty in Measurements
   5. Significant Figures
   6. Problem Solving and Dimensional Analysis
   7. Temperature Conversions
   8. Density
   9. Problem Solving

C. Matter and Energy
   1. Matter
   2. Physical and Chemical Properties and Changes
   3. Elements and Compounds
   4. Mixtures and Pure Substances
   5. Separation of Mixtures
   6. Energy and Energy Changes

D. Chemical Foundations: Elements and Atoms
   1. The Elements
   2. Symbols
   3. Dalton's Atomic Theory
   4. Formulas of Compounds
   5. The Structure of the Atom
   6. Modern Concept of Atomic Structure
   7. Isotopes
   8. The Periodic Table

E. Elements, Ions and Nomenclature
   1. Natural States of the Elements
   2. Ions
   3. Compounds That Contain Ions
   4. Naming Compounds
      a. Elements
      b. Binary Compounds
         i. Metals with Nonmetals
         ii. Nonmetals with Nonmetals
      c. Ternary Compounds
      d. Acids
   5. Writing Formulas from Names

F. Chemical Reactions: An Introduction
   1. Evidence for a Chemical Reaction
   2. Chemical Equations
   3. Balancing Chemical Equation

G. Reactions in Aqueous Solutions
    1. Predicting Whether a Reaction Will Occur
    2. Reactions in Which a Solid Forms
    3. Describing Reactions in Aqueous Solutions
    4. Acid-Base Reactions

H. Classifying Chemical Reactions
    1. Oxidation-Reduction
    2. Combination
    3. Decomposition
    4. Replacement
    5. Acid-Base

I. Chemical Composition
    1. Counting by Weighing
    2. Atomic Masses
    3. The Mole
    4. Molar Masses
    5. Percent Composition of Compounds
    6. Formulas of Compounds
    7. Calculation of
        a. Empirical Formulas
        b. Molecular Formulas

J. Chemical Quantities
    1. Stoichiometry
    2. Mole-Mole Relationships
    3. Mass Calculations
    4. Limiting Reagents
    5. Percent Yield

K. Modern Atomic Theory
    1. Electromagnetic Radiation and Energy
    2. The Energy Levels of Hydrogen
    3. The Bohr Model of the Atom
    4. The Wave Mechanical Model of the Atom
    5. Electron Arrangements and the Periodic Table
    6. Atomic Properties and the Periodic Table

L. Chemical Bonding
    1. Types of Chemical Bonds
    2. Electronegativity
    3. Bond Polarity and Dipole Moments
    4. Stable Electron Configurations and Charges on Ions
    5. Ionic Bonding and Structures of Ionic Compounds
    6. Lewis Structures
    7. Lewis Structures of More Complex Molecules
    8. Molecular Structure - The VSEPR Model

M. Gases
    1. Pressure
    2. Boyle's Law
    3. Charles' Law
    4. Avogadro's Law
    5. Ideal Gas Law
    6. Dalton's Law
    7. The Kinetic Molecular Theory
    8. Gas Stoichiometry

N. Liquids and Solids
    1. Water and Its Phase Changes
    2. Energy Requirements for the Changes of State
    3. Intermolecular Forces of Attraction
    4. Boiling Points
    5. Evaporation and Vapor Pressure
    6. Types of Solids
    7. Bonding in Solids

O. Solutions
    1. Solubility
    2. Solution Composition
        a. Mass Percent
        b. Molarity
    3. Dilution
    4. Stoichiometry of Solution Reactions
    5. Neutralization Reactions

P. Acids and Bases
    1. Definitions
    2. Acid Strength
    3. Water as an Acid and Base
    4. The pH Scale
    5. Calculating the pH of strong acid solutions
    6. Buffered Solutions