San Bernardino Valley College
Curriculum Approved: November 18, 2002
Last Updated: November 15, 2002

I. CATALOG DESCRIPTION:

A. Department Information:

Division:	Science and Math
Department:	Chemistry
Course ID:	CHEM 213
Course Title:	Organic Chemistry II
Units:	4 Units
Lecture:	3 Hours
Laboratory:	3 Hours
Prerequisite:	CHEM 212 or CHEM 212H

B. Catalog and Schedule Description: Second semester of organic chemistry. A study of carbon compounds including aliphatic, aromatic and heterocyclic series, and modern theoretical concepts. Includes modern instrumentation, mechanisms, synthesis and functional groups. Laboratory includes preparation and study of properties, and extensive identification of organic compounds.

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: One

III. EXPECTED OUTCOMES FOR STUDENTS:

Upon completion of the course, the student should be able to:

A. Analyze and interpret spectroscopic results – Infrared Spectroscopy, Nuclear
B. Magnetic Resonance Spectroscopy, Carbon-13 NMR Spectroscopy, and Mass Spectrometry
C. Identify aromatic compounds.
D. Recognize Electrophilic Aromatic Substitution Reactions and predict products and reagents.
E. Identify and predict reactions at the carbonyl group – nuceophilic addition reactions and condensation reactions.
F. Recognize and formulate reactions resulting from the formation of the enolate ion.
G. Recognize and predict nucleophilic substitution reactions of acyl compounds (the carboxylic acids and their derivatives.)
H. Recognize and predict reactions of amines, phenols, and aryl halides.
I. Identify structures and functions of biological compounds (carbohydrates, lipids, amino acids, and nucleic acids). Analyze and predict reactions of these biological compounds. Formulate the polymers formed from the biological monomers.
J. In the laboratory, develop more refined lab skills. Refine skills in operating lab equipment, like the infrared spectrometer. Use lab skills and technology to identify unknown organic compounds.

IV. CONTENT:

Lecture:

A. Spectroscopic Methods of Determining Structure
   1. Infrared Spectroscopy
   2. Proton Nuclear Magnetic Resonance Spectroscopy
   3. Carbon-13 NMR
   4. Mass Spectrometry
B. Aromatic Compounds
   1. Nomenclature of benzene compounds
   2. Stability of benzene
   3. Aromaticity
   4. Other aromatic compounds

C. Reactions of Aromatic Compounds
   1. Electrophilic Aromatic Substitution mechanism and reactions
   2. Friedal-Crafts alkylation and acylation
   3. Effect of substituent on reactivity and orientation – ortho, para, meta directors
D. Aldehydes and Ketones
   1. Nomenclature and physical properties
   2. Synthesis of aldehydes and ketones
   3. The Carbonyl group and its reactions-nucleophilic addition
   4. Analysis of aldehydes and ketones
   5. Aldol reactions
   6. The enolate ion formation
   7. Keto and Enol Tautomers
E. Carboxylic Acids and their Derivatives
   1. Nomenclature and physical properties
   2. Acyl group and its reactivity
   3. Synthesis and reactivity of acyl compounds
F. Beta Dicarbonyl Compounds
   1. More chemistry of the enolate ion
   2. Claisen Condensation
   3. Acetoacetic Ester Synthesis
   4. Malonic Ester Synthesis
   5. More condensation and addition reactions
   6. Enamine synthesis
G. Amines
   1. Nomenclature and physical properties
   2. Basicity of amines
   3. Biological amines
   4. Preparation and reactions of amines
   5. Reactions of arenediazonium slats
   6. Analysis of amines
H. Phenols
   1. Structure, nomenclature, physical properties
   2. Synthesis of phenols
   3. Reactions of phenols as acids
   4. Reactions of the “OH” group
   5. Reactions of the benzene ring
I. Aryl Halides
   1. Nucleophilic Aromatic Substitution
   2. Mechanisms: Addition-Elimination and Elimination –Addition
   3. Analysis of aryl halides and phenols
J. Carbohydrates
   1. Monsaccharide structure and nomenclature
   2. Mutarotation
   3. Reactions of monosaccharides: glycosides, oxidation, reduction
   4. Synthesis and degradation of monosaccharides
   5. Fischer proof of glucose structure
   6. Disaccharides
   7. Polysaccharides
K. Lipids
   1. Fatty Acids and triacylglycerols
   2. Reactions of lipids
   3. Other lipids: terpenes, steroids, prostaglandins, phospholipids

L. Amino Acids and Proteins
   1. Amino acid structure and properties
   2. Synthesis of amino acids
   3. Analysis of peptides and proteins
   4. Primary, secondary, and tertiary structures of proteins
   5. Introduction to enzymes

M. Nucleic Acids
   1. Nucleotides and nucleosides
   2. DNA structure and function
   3. RNA structure and function
   4. Determining Base sequence of DNA
   5. Modern DNA technology

N. Optional Topics
   1. Reactions and synthesis of heterocyclic amines
   2. Thiols, thioethers, and thiophenols
   3. Electrocyclic and cycloaddition reactions
   4. Thio esters and lipid biosynthesis

Laboratory: Skills are refined with more microscale laboratory experiments. The FTIR is used more extensively, and other instruments learned first semester continued to be used. Identification of unknowns is also done this semester.

V. METHODS OF INSTRUCTION:

A. Lecture
B. Laboratory
C. Work Groups
D. Video
E. Multimedia
F. Discussion
G. Examination
H. Demonstration
I. Computer Drills
J. Molecular Model Exercises

VI. TYPICAL ASSIGNMENTS:

A. Lecture: Read chapter on “Reactions of Aromatic Compounds” and do problems assigned.
B. Laboratory: Review assigned techniques. Read the essay on Sulfa Drugs and complete assigned experiment on “Sulfa Drugs: Preparation of Sulfanilamide.” In the lab report answer the assigned question found at the end of the lab procedures.

VII. EVALUATION(S):

A. Methods of Evaluation
   1. Examinations
      a) Typical multiple choice type of question: Which of the following would not be a contributor to the resonance hybrid of the benzyl cation?
      b) Typical problem solving question: Starting with toluene, outline a synthesis of 4-chloro-2nitrobenzoic acid.

2. Laboratory Performance: Criteria:
   a) Attendance
   b) Participation
   c) Safety Skills
   d) Lab Quizzes
   e) Lab reports with evidence of accurate and honest reporting of data and observations and critical thinking demonstrated in the "Conclusion" of the report.
3. Typical Lab assignment: A complete lab report is due for each lab. The report includes Purpose, Reactions, Procedures, Results (all masses, calculations, percent yields, melting or boiling point, IR, etc.), Conclusion, and assigned questions.
4. Typical Lab question: Explain why benzocaine precipitates during the neutralization.
5. Optional evaluations:
   a) Quizzes in lecture
   b) Computer assignments checked
   c) Homework evaluated

B. Frequency of Evaluations
1. Exams are given several times a semester, usually four a semester, with a comprehensive final given during "finals week."
2. Quizzes (optional) are given each week on the homework.
3. Lab work and assignments are turned in weekly.

VIII. TYPICAL TEXT(S):

Solomons, Organic Chemistry, 6th ed., New York, NY; John Wiley and Sons, 1996.
Solomons, Study Guide & Solutions Manual, 6th ed, New York, NY; John Wiley & Sons, 1996.
Pavia, Lampman, Kriz, Engel, Organic Laboratory Techniques, A Microscale Approach, 2nd ed., San Diego, CA; Saunders College Publishing, 1995.
Brown & Foote, Organic Chemistry, 2nd ed., San Diego, CA; Saunders College Publishing, 1998.
Brown & Foote, Solutions Manual, 2nd ed., San Diego, Ca; Anders College Publishing, 1998.

IX. OTHER SUPPLIES REQUIRED OF STUDENTS: Organic Molecular Model Kit