

A. CATALOG DESCRIPTION (include prerequisites)

Course Title: Organic Chemistry II
Credits: 5
Hours/Week: 4 hours lecture per week, 3 hours lab per week
Semester Offered: Spring
Prerequisites: CHEM 2127

This course meets the Minnesota Transfer Curriculum in NS (Natural Science) and CT (Critical Thinking).

A continued introduction to functional groups and biomolecules of interest. An introduction to carbonyl compounds and addition reactions of electrophilic carbon atoms is presented. Nucleophilic substitution reactions of carboxylic acids and their derivatives is presented. Alkylation and condensation reactions are covered. An introduction to theory and interpretation of mass spectroscopy, IR and NMR is presented. Reactions of enolate ions and amines are presented. A thorough introduction to organic synthesis is covered.

B. DATE LAST REVISED (use current date): April 2006**C. RECOMMENDED ENTRY SKILLS/KNOWLEDGE:**

College-level reading and writing skills and working knowledge of intermediate algebra

D. OUTLINE OF MAJOR CONTENT AREAS:

1. Alcohols and Ethers
 - a. Structure and nomenclature of alcohols and ethers
 - b. Physical properties of alcohols and ethers
 - c. Preparation of alcohols and ethers
 - d. Chemical reactions of alcohols and ethers
 - e. Synthesis problems
2. Aldehydes and Ketones.
 - a. Structure and nomenclature of aldehydes and ketones
 - b. Physical properties of aldehydes and ketones
 - c. Preparation of aldehydes and ketones
 - d. Chemical reactions of aldehydes and ketones
 - e. Synthesis problems

D. OUTLINE OF MAJOR CONTENT AREAS: continued

3. Mass Spectrometry
 - a. The mass spectrum
 - b. The molecular ion
 - c. Important fragmentation pathways
 - d. Rearrangement of molecular ions
 - e. Interpretation of the mass spectrum
4. Infrared
 - a. The electromagnetic spectrum and absorption spectroscopy
 - b. Molecular vibrations and absorption frequencies in the infrared region
 - c. Using infrared spectroscopy to study chemical transformations.
 - d. Infrared spectra of compounds containing various functional groups
5. Nuclear Magnetic Resonance Spectroscopy
 - a. Introduction to nuclear magnetic resonance spectra
 - b. Chemical shift and identification of functional environments
 - c. Spin-spin coupling
 - d. Proton and carbon-13 NMR
 - e. Identification of chemical compounds by NMR
 - f. Medical applications of nuclear magnetic resonance
6. Carboxylic Acids and their Derivatives.
 - a. Introduction to carboxylic acids and their derivatives
 - b. Structure and nomenclature of carboxylic acids
 - c. Physical properties of carboxylic acids and their derivatives
 - d. Preparation of carboxylic acids and their derivatives
 - e. Chemical reactions of carboxylic acids and their derivatives
 - f. Synthesis problems
7. Enols and Enolate Anions as Nucleophiles
 - a. Reactions of enols and enolates
 - b. Thermodynamic versus kinetic enolates
 - c. The Aldol Condensation
 - d. The Claisen Condensation
 - e. The Dieckmann Condensation
8. The Chemistry of Amines
 - a. Structure and nomenclature of amines
 - b. Physical properties of amines
 - c. Preparation of amines
 - d. Chemical reactions of amines
 - e. Synthesis problems
9. Laboratory activities included are synthesis based and correlated with the lecture material. Methods used to analyze product include melting point, boiling point, density, IR spectroscopy, NMR spectroscopy, and percent yield.

E. LEARNING OUTCOMES (GENERAL):

1. Basic knowledge in the preparation and reactions of alkynes, alcohols, aldehydes, ketones, carboxylic acids, carboxylic acid derivatives, and amine compounds.
2. Organic Synthesis
 - a. Transformation and interconversion of functional groups
 - b. The use of protecting groups
 - c. Advanced strategies in organic synthesis
3. Intermediate organic nomenclature and terminology
4. Understanding reaction mechanisms
5. Applications of organic chemistry in everyday life including environmental concerns
6. Basic understanding of mass spectroscopy, NMR and IR Spectroscopy in organic structural determination
7. Laboratory learning outcomes include:
 - a. How to determine the purity of a product based on spectroscopic and chemical means.
 - b. How to isolate a product using solubility and other physical characteristics
 - c. How to synthesize various compounds and determine percent yield of the reaction.

F. LEARNING OUTCOMES (MNTC):

Critical Thinking

- a. Gather factual information and apply it to a given problem in a manner that is relevant, clear, comprehensive and conscious of the bias in the information selected.
- b. Be able to imagine and seek out a variety of possible goals, assumptions, interpretations or perspectives which can give alternative meaning to a given problem.
- c. Analyze the logical connections between facts, goals and implicit assumptions relevant to a problem and evaluate claims which may be said to follow from them.
- d. Describe and improve their own critical thinking and problem solving procedures.

Natural Science

- a. Demonstrate understanding of scientific theories and the ways in which scientists develop, express and question theories in the field of organic chemistry.
- b. Formulate hypotheses when presented with experimental data based on concepts learned.
- c. Evaluate societal issues from a natural science perspective, ask questions about the evidence presented, and make informed judgments about organic chemistry-related topics and policies.

G. METHODS FOR EVALUATION OF STUDENT LEARNING:

Several broad coverage problem solving unit tests covering the outcomes listed above are given for the major part of the grade. Also, several problem type quizzes are given over smaller but similar areas. Weekly laboratory reports constitute the remainder of the evaluation.

H. SPECIAL INFORMATION (fees, directives on hazardous materials, etc.):

The initial lab session explains and familiarizes the student with general safety equipment in the lab and requires students to map all safety equipment in the lab. During the pre-lab discussion, the hazardous characteristics of the chemicals used during the lab are discussed. The students will be instructed on the proper disposal of all products. The instructor directs all students to wear necessary eye protective equipment while working in a situation where there is a potential danger of eye damage. Students with special needs and concerns (i.e., people with allergies, pregnant females, sufferers of diseases which lower the effectiveness of their immune system) may wish to make this known to the instructor so that any chemical which might affect your situation can be avoided. A copy of Material Safety Data Sheets for chemicals used is available in the lab.