

**Kaskaskia College Course Syllabus  
CHEM 209**

**I. COURSE LOCATION**

**X ON CAMPUS CCC**

**II. COURSE IDENTIFICATION**

**PREFIX: CHEM NUMBER: 209 NAME: Organic Chemistry II**

<b>3</b>	<b>LECTURE HOURS</b>	<b>LIBA 04900</b>	<b>CURRICULUM &amp; NO.</b>
<b>4</b>	<b>LABORATORY HOURS</b>	<b>1.1/400504</b>	<b>PCS-CIPS NUMBER</b>
<b>5</b>	<b>CREDIT HOURS</b>	<b>N</b>	<b>VARIABLE (Y/N)</b>
<b>0</b>	<b>CLINICAL HOURS</b>	<b>N</b>	<b>REPEATABLE (Y/N)</b>
<b>0</b>	<b>SOE HOURS</b>	<b>0</b>	<b>TIMES</b>

**III. DIVISION TO WHICH COURSE IS ASSIGNED**

**X BACCALAUREATE/TRANSFER**  
CAREER EDUCATION  
CONTINUING COMMUNITY EDUCATION  
ABE/ASE  
HEALTH OCCUPATIONS  
OTHER

**IV. CATALOG DESCRIPTION OF COURSE**

Topics include aldehydes and ketones, carboxylic acids and derivatives, dicarbonyl compounds, carbohydrate, amines, amino acids and proteins, heterocyclic compounds, and nucleic acids. Laboratory required.

**V. PREREQUISITES FOR THE COURSE**

CHEM 111 or CHEM 112

**VI. METHODS OF INSTRUCTION**

<b>DISCUSSION- LECTURE</b>	<b>SEMINAR</b>
<b>LABORATORY</b>	TELE-LECTURE (FILM-TV)
CORRESPONDENCE	LABORATORY-DISCUSSION
TELEVISION (TELECOURSE)	LECTURE
RADIO	<b>X LECTURE-LABORATORY</b>
INDEPENDENT STUDY	OTHER (IDENTIFY):ONLINE
CO-OP	DISCUSSION

**VII. OBJECTIVES OF THE COURSE (USE ADDITIONAL PAGES AS NECESSARY)**

- A. To introduce basic organic chemistry with understanding of the fundamentals of chemical bonding and structure.
- B. To introduce the classification of organic compounds with their nomenclature and functional groups.

- C. To provide the knowledge of conformation, geometry, configuration or stereochemistry of organic compounds.
- D. To introduce the basic reactions and synthesis of organic compounds.
- E. To provide the knowledge of reaction mechanisms of different types of organic reactions and their synthetic applications.
- F. To introduce spectroscopic techniques to characterize and analyze organic and biochemical molecules.
- G. To provide students with laboratory experiences in regards of synthesis, purification, and analysis of organic compounds.

VIII. A. REQUIRED TEXTBOOK(S)

TITLE: Microscale and Miniscale Organic Chemistry

AUTHOR(S): Schoffstall, Gaddis, and Druelinger

COPYRIGHT DATE: 2004                      EDITION: 2<sup>nd</sup>

ISBN# 0-07-242456-7

TITLE: Organic Chemistry

AUTHOR(S): Francis A. Carey

COPYRIGHT DATE: 2006                      EDITION: 6th

McGraw Hill

ISBN#: 0-07-282837-4

B. REQUIRED WORKBOOK(S)/LAB MANUALS

TITLE: Macroscale and Microscale Organic Experiment

AUTHOR(S): Williamson

COPYRIGHT DATE: 1994                      EDITION: Second

PUBLISHING COMPANY: Houghton Mifflin

IX. SUPPLEMENTARY INSTRUCTIONAL MATERIALS IDENTIFY GENERAL SOURCES:

IF EXTENSIVE COLLATERAL READINGS ARE REQUIRED FROM SPECIFIC BOOKS, PROVIDE INFORMATION.

X. METHODS OF EVALUATION OF STUDENTS ENROLLED IN THE COURSE

Written exams, laboratory reports, homework, quizzes and others.

XI. COURSE OUTLINE

**LECTURE**

- A. Structure and bonding of organic compounds. Hybridization and molecular shapes of alkanes, alkenes, alkynes, cycloalkanes. Alcohols and phenols.
- B. Stereochemistry of nucleophilic, electrophilic substitution, and elimination reactions.
- C. Conjugated dienes and aromatic substitution reactions.
- D. Aldehydes and ketones. Carbonyl condensation reactions. Malonic ester and beta-keto ester synthesis.
- E. Carboxylic acids and their derivatives.
  - 1. The reactions of carboxylic acids including acyl substitution reactions.
  - 2. Mechanism of Acid-Catalyzed Esterification.

- F. Amines and their general reactions including Hoffman Elimination.
  - 1. Azo-coupling
  - 2. Amino acids
  - 3. Peptides
  - 4. Proteins
  - 5. Stereochemistry of amino acids
  - 6. Acid-base behavior of amino acids
  - 7. Amino acid analysis including End Group Analysis
  - 8. Structures (primary, secondary, tertiary, and quaternary structure of protein).
- G. Carbohydrates
  - 1. Basic units
  - 2. Structure
  - 3. D-L notation
  - 4. Classification
  - 5. Furanose and pyranose forms
  - 6. Mutarotation
  - 7. Glycosides and glycoproteins
  - 8. Disaccharides and polysaccharides
- H. Lipids, fats, oils, and fatty acids
  - 1. Acetyl coenzyme A and TCA cycle
  - 2. Phospholipids
  - 3. Cholesterol (bad and good cholesterol)
  - 4. Steroids
  - 5. Basic knowledge of hormones
- I. Hetero-cyclic aromatic compounds: Syntheses, structure, and reactions.
- J. Pyrimidine and purine bases of nucleosides, nucleotides, and nucleic acids
  - 1. Structure and replication of DNA
- K. Spectroscopic techniques (IR and NMR) to characterize organic compounds
- L. Organometallic compounds

## **XII. LABORATORY**

- A. Esterification and hydrolysis. Esterification of cholesterol and characterization of cholesterol esters
- B. The Friedel-Crafts reaction
  - 1. Anthraquinone and anthracene
  - 2. Acylation of ferrocene
  - 3. Acetylferrocene
- C. Synthesis and characterization of acetylsalicylic acid (Aspirin)
- D.  $\alpha$ -phenylcinnamic acid (Perking Reaction).
- E. Malonic ester synthesis: Barbiturate
- F. Carbohydrates and sweeteners
- G. Enzymatic reactions
- H. Polymers: synthesis and recycling
- I. Characterization of organic compounds by spectroscopic methods (Mass, IR and NMR and UV-VIS).
- J. Spectrophotometric analysis of organic and biological samples.

### **XIII. THE LEARNING OUTCOME**

1. The students should be able to identify covalent bonding, structures, hybrid orbitals, bond angles, geometry, and polarity of carbon compounds.
2. The students should be able to draw hybrid orbital diagrams of the carboxylic acids and their derivatives including the resonance structures of carboxylic acids.
3. They should be able to explain why the carboxylic acids are acids. They should
4. be able to learn memorize the rules of IUPAC names of the carboxylic acids and their derivatives.
5. The students should be able to know what  $pK_a$  is. How  $pK_a$  is related to the acidity of the carboxylic acids.
6. They should be able to write down the mechanism of Malonic Ester Synthesis, Acetoacetic Acid Synthesis and Aldol Condensation, Claisen and Perkin Condensations and the synthesis of organic compounds based on those reactions.
7. The students should be able to understand the applications of Diazonium compounds in organic synthesis.
8. The students should be able to identify different classes of amines and their derivatives including peptide bond formations.
9. They should be able to classify the amino acids based on their side chains.
10. They should be able to calculate the  $pK_a$  values for zwitterions.
11. They should be able to understand the formation of polymers of amino acids, the structures of proteins including enzymes with some mechanisms.
12. The students should be able to understand how nucleic acids are formed including their classifications, naming and structures, differences, replications, and protein synthesis by nucleic acid.
13. They should be able to understand the formation and structures of lipids and fats.
14. They should be able to identify the asymmetric or chiral centers, to identify D, and L and d and l configurations and R, and S configurations.
15. They should be able to draw the cyclic structures of carbohydrates and also, understand the metabolism of glucose including TCA cycle.
16. The students should be able to characterize organic compounds by various spectroscopic methods including NMR (proton and C-13) techniques.
17. They should be able to synthesize organic compounds in the laboratory, separate (using chromatographic techniques), purify (including crystallization) and characterize organic compounds