

This syllabus is provided as a general informational guide. Some of the information may vary depending on the specific course section and instructor. Different sections of the same course may require different textbooks. Verify the section specific textbook information in the CUNY's Academic Course Schedule Web Page. Modifications of the grading system presented here will be communicated by the instructors of the sections when they meet the class.

BOROUGH OF MANHATTAN COMMUNITY COLLEGE

City University of New York

Department of Science

Title of Course: Organic Chemistry II
CHE 240
Semester:
Credits: 5

Class hours: 3
Lab hours: 4
Instructor:
Phone:
Email:

Course Description

This two-semester course sequence is the study of the structure and properties of the fundamental classes of organic compounds with emphasis on reactivity, reaction mechanism, stereochemistry, electronic theory and applications to allied fields.

Basic Skills: ACR 94, ENG 088 or ESL 54, and MAT 051

Prerequisites/Co-requisites: MAT 056, CHE 201, CHE 202, and CHE 230.

Student Learning Outcomes

Students will be able to discuss and show proficiency in topics related to:

- ❖ Structure determination using Infrared and Proton Nuclear Magnetic Resonance Spectroscopy.
- ❖ Conjugated dienes and their reactivity, the Diels-Alder reaction.
- ❖ Benzene, Aromaticity, and Hückel's $4n + 2$ and $4n$ rules.
- ❖ Chemistry of Benzene: electrophilic and nucleophilic aromatic substitution reactions such as Friedel-Crafts alkylation/acylation, aromatic halogenation, nitration, sulfonation, etc.
- ❖ Structure, reactivity, reactions and synthesis of alcohols, phenols, ethers, and epoxides.
- ❖ Structure, reactivity, reactions and synthesis of carbonyl containing compounds such as aldehydes, ketones, carboxylic acids, esters, anhydrides, and amides.
- ❖ Nucleophilic addition reactions of aldehydes and ketones.
- ❖ Carbonyl alpha-substitution reactions.
- ❖ Organic transformations of carboxylic acids and nitriles.
- ❖ Synthetic organic techniques for the building of small and large molecules and to show their relationship with biological structures.
- ❖ Organic laboratory techniques and skills to synthesize, separate, purify and characterize (by chemical and spectroscopic techniques) organic compounds.

Assessment: Exam questions, homework and laboratory assignments

Evaluation & Requirements of Students

Each semester there will be a minimum of three examinations, a comprehensive final examination, and fulfillment of laboratory requirement. The average of your lecture exams and final exam grades must be greater than 60% to permit a passing grade, regardless of your laboratory grade.

Below are the college's general education learning outcomes, the outcomes that are checked in the left-hand column indicate goals that will be covered and assessed in this course.

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	General Education Learning Outcomes	Measurements (means of assessment for general education goals listed in first column)
<input type="checkbox"/>	Communication Skills- Students will be able to write, read, listen and speak critically and effectively.	
<input checked="" type="checkbox"/>	Quantitative Reasoning- Students will be able to analyze elucidate the structure of organic compound by using Spectroscopy methods. Students will be able to recognize the organic functional groups and perform multistep to change the initial organic structure.	By identifying organic compounds using Infrared and ^1H NMR spectrometric instruments. By performing qualitative analysis of organic compounds possessing different functional groups. By performing multisteps transformations to select organic compounds.
<input checked="" type="checkbox"/>	Scientific Reasoning- Students will be able to apply the concepts and methods of the natural sciences.	Exam questions to propose multistep transformations, homework assignment, laboratory assignments and case study.
<input type="checkbox"/>	Social and Behavioral Sciences- Students will be able to apply the concepts and methods of the social sciences.	
<input type="checkbox"/>	Arts & Humanities- Students will be able to develop knowledge and understanding of the arts and literature through critiques of works of art, music, theatre or literature.	
<input type="checkbox"/>	Information & Technology Literacy- Students will be able to collect, evaluate and interpret information and effectively use information technologies.	
<input type="checkbox"/>	Values- Students will be able to make informed choices based on an understanding of personal values, human diversity, multicultural awareness and social responsibility.	

Required Text & Readings

1. *Organic Chemistry*, 2nd Ed by David Klein, John Wiley & Sons, Inc., 2014 ISBN 978-1-118-45431-2 (binder ready version).
2. *A small Scale Approach to Organic laboratory Techniques*, 3rd Ed. by Donald Pavia, Gary Lampman, George Kriz and Randall Engel, Brooks/Cole Cengage Learning, 2011 ISBN-13: 978-1-4390-4932-7 and ISBN-10: 1-4390-4932-7.

Other Resources (Highly recommended)

1. *Student Study Guide and Solutions Manual*, 2nd Ed by David Klein, Edition binder ready version, ISBN; 978-1-118-70081-5, John Wiley & Sons, Inc., 2012.
2. Lab coats or aprons
3. Molecular modeling kit

The laboratory will be evaluated in preparation, work, and report. A student who is absent from more than one laboratory session seriously jeopardizes his/her grade for the course.

The students are encouraged to work as many problems found at the end of the chapter until the main content of the chapter is mastered. The use of the molecular models is recommended to visualize the stereochemistry and the three-dimensional aspect of the organic compounds. The *Student Study Guide and Solutions Manual* is useful for checking your answers to homework and practice questions.

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Outline of Topics

Chapter	Lecture Topics
12	Synthesis One-Step and Multi-Step Syntheses. Functional Group Transformations. Reactions that Change the Carbon Skeleton. How to Approach a Synthesis Problem. Retrosynthetic Analysis. Practical Tips for Increasing Proficiency.
13	Alcohols and Phenols Structure and Properties of Alcohols. Acidity of Alcohols and Phenols. Preparation of Alcohols via Substitution or Addition. Preparation of Alcohols via Reduction. Preparation of Diols. Preparation of Alcohols via Grignard Reagents. Protection of Alcohols. Preparation of Phenols. Reactions of Alcohols: Substitution and Elimination. Reactions of Alcohols: Oxidation. Biological Redox Reactions. Oxidation of Phenol. Synthesis Strategies.
14	Ethers and Epoxides; Thiols and Sulfides Introduction, Nomenclature, Structure, Properties Preparation and Reactions of Ethers. Nomenclature and Preparation of Epoxides. Enantioselective Epoxidation. Ring-Opening Reactions of Epoxides. Thiols and Sulfides. Synthesis Strategies Involving Epoxides.
15	Infrared Spectroscopy Introduction to Spectroscopy. Infrared Spectroscopy. Signal Characteristics: Wavenumber, Intensity, Shape. Analyzing an Infrared Spectrum. Using Infrared Spectroscopy to Distinguish between Two Compounds. Hydrogen Deficiency Index: Degrees of Unsaturation.
16	Nuclear Magnetic Resonance Spectroscopy Introduction to NMR Spectroscopy. Acquiring a ^1H NMR Spectrum. Characteristics of a ^1H NMR Spectrum. Number of Signals. Chemical Shift. Integration. Multiplicity. Drawing the Expected ^1H NMR Spectrum of a Compound. Using ^1H NMR Spectroscopy to Distinguish between Compounds. Analyzing a ^1H NMR Spectrum.
17	Conjugated Pi Systems and Pericyclic Reactions Classes of Dienes. Conjugated Dienes. Molecular Orbital Theory. Electrophilic Addition. Thermodynamic Control vs. Kinetic Control. An Introduction to Pericyclic Reactions. Diels-Alder Reactions. MO Description of Cycloadditions. Electrocyclic Reactions. Sigmatropic Rearrangement. UV-VIS Spectroscopy.
18	Aromatic Compounds Introduction. Nomenclature of Benzene Derivatives. Structure and Stability of Benzene. Aromatic Compounds Other than Benzene. Reactions at the Benzylic Position. Reduction of the Aromatic Moiety. Spectroscopy of Aromatic Compounds.
19	Aromatic Substitution Reactions Introduction. Halogenation. Sulfonation. Nitration. Friedel-Crafts Alkylation and Acylation. Activating and Deactivating Groups. Directing Effects of a Substituent. Multiple Substituents Synthesis Strategies. Nucleophilic Aromatic Substitution. Elimination-Addition. Mechanism of an Aromatic Substitution Reaction.
20	Aldehydes and Ketones Introduction, Nomenclature, and Preparation. Nucleophilic Addition Reactions. Mechanism. Oxygen, Nitrogen, Sulfur, Hydrogen, and Carbon Nucleophiles. Baeyer-Villiger Oxidation of Aldehydes and Ketones. Synthesis Strategies. Spectroscopic Analysis.

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21 Carboxylic Acids and Their Derivatives

Introduction, Structure, Properties, Reactions, and Derivatives. Preparation and Reactions of Acid Chlorides, Acid Anhydrides, Esters, Amides, and Nitriles. Synthesis Strategies. Spectroscopy of Carboxylic Acids and Their Derivatives.

22 Alpha Carbon Chemistry, Enols and Enolates

Introduction. Alpha Halogenation. Aldol Reactions. Claisen Condensations. Alkylation of the Alpha Position. Conjugate Addition Reactions. Synthesis Strategies.

CHE 240 LABORATORY SCHEDULE

Week	Experiment Title
1	Laboratory Safety and Laboratory Rules and Check-in
2	Infrared Spectroscopy analysis of selected compounds
3	NMR Spectroscopy analysis of selected compounds
4	Lecture on Chapter 12
5	Qualitative analysis of Alcohols (Handout)
6	Extraction of Thymol (Handout)
7	Classification tests (Handout)
8	Diels - Alder reaction
9	Nitration of Methylbenzoate
10	The Cannizzaro Reaction
11	Qualitative analysis of Aldehydes and Ketones (Handout)
12	Acetylsalicylic acid – Ester formation
13	Aldol reaction (Handout)
14	Lab Final

College Attendance Policy

At BMCC, the maximum number of absences is limited to one more hour than the number of hours a class meets in one week. For example, you may be enrolled in a three-hour class. In that class, you would be allowed 4 hours of absence (not 4 days). In the case of excessive absences, the instructor has the option to lower the grade or assign an F or WU grade.

Academic Adjustments for Students with Disabilities

Students with disabilities who require reasonable accommodations or academic adjustments for this course must contact the Office of Services for Students with Disabilities. BMCC is committed to providing equal access to all programs and curricula to all students.

BMCC Policy on Plagiarism and Academic Integrity Statement

Plagiarism is the presentation of someone else's ideas, words or artistic, scientific, or technical work as one's own creation. Using the idea or work of another is permissible only when the original author is identified. Paraphrasing and summarizing, as well as direct quotations require citations to the original source. Plagiarism may be intentional or unintentional. Lack of dishonest intent does not necessarily absolve a student of responsibility for plagiarism.

Students who are unsure how and when to provide documentation are advised to consult with their instructors. The library has guides designed to help students to appropriately identify a cited work. The full policy can be found on BMCC's web side, www.bmcc.cuny.edu. For further information on integrity and behavior, please consult the college bulletin (also available online).