



## SYLLABUS

### A. Course Description

Course Code	Course Num.	Course Name	Credit Hours	Lec.	Lab.	Tut.	Private study	Pre-requisites	Course Level	Language
CHM	121	Organic Chemistry (1)	4	2	2	2	8	CHM 101	2	English

This course is an introduction to the chemistry of carbon. The concepts of bonding, structure, and functional groups of Alkanes, Alkenes, Alkynes, Alkyl halides will be covered, as well as reactions of their reactions and confirmations of isomers is presented. In addition, introduction to Aromaticity will be covered. In the laboratory part, experiments are designed to give students essential techniques such as identification of physical properties of organic compounds and classification of functional groups. At the end of this course the student will be able to:

- To determine the concepts of chemical bonding and hybridization for organic compounds.
- To understand the drawing structural formula for organic compounds.
- To name alkanes, cycloalkanes, alkenes, cycloalkenes, alkynes, alkyl halides according to IUPAC system.
- To describe preparation and reactions of alkanes, alkenes, and alkyl halides
- To recognize the types of organic reactions.
- To outline Chemical Behaviors of aliphatic organic compounds
- To recognize the Stereochemistry of alkenes, and cycloalkanes structure.
- To explain the aromaticity system for organic compounds.
- To define Structures and Reactivity relation.
- To list the basic reactions covered in the required basic organic chemistry course.
- To use glassware and equipments in organic laboratory.
- To safely handel chemicals.

### B. References: Required Textbook & Internal Website

I shall use

**Organic Chemistry**, John E. McCurry, Mary Finch, (8<sup>th</sup> Ed.), Cengage Group, 2012, | ISBN-10: 0495118370 | ISBN-13: 978-0495118374.

**Students are required to purchase the textbook/materials (it is an obligation).** The book contains the lecture notes as well as activities for the students to take part in; the book serves as a workbook.

Other references:

- **Organic Chemistry**. Paula Yurkanis Bruice, (2<sup>nd</sup> Ed.), Prentice Hall, Upper saddle River New Jersey 07458), 1998, ISBN-10: 0321803221.
- **Organic Chemistry**, Morrison, R. T.; Boyd, R. N. (6<sup>th</sup> Ed.), Prentice Hall of India, (1996), ISBN-10: 0136436692.
- **Vogel's' Textbook of Practical Organic Chemistry**, Vogel, A.I., Tatchell, A.R., Furnis, B.S., Smith, P.W.G, Longman Group UK Limited, (5<sup>th</sup> Ed.) 1989 ISBN 978-0-582-46236-6

Google Classroom Webpage: <http://www.imamm.org/>



### C. Topics Outline

**Disclaimer:** this is a very fast-paced course. There will be little time—if any—for review. What follows is an approximate outline of the pace of the course. We may go faster or slower, contingent on the class response. The tentative list of topics to cover:

*a. Theory:*

- 1. Atomic Structure:** The nucleus, Orbitals, Electron Configurations, Development of chemical bonding theory, Valence bond Theory,  $sp^3$ ,  $sp^2$ ,  $sp$  Hybrid orbitals and the structure of Methane, Ethane, Ethylene and acetylene, The Nature of the chemical bonds, Drawing Chemical Structures.
- 2. Covalent Bonds:** Acids and Bases. Polar Covalent Bonds, Formal Charges, Resonance, Rules of Resonance Forms, Drawing for Resonance Forms, Acids and bases, The Bronsted-Lowry definition, Acid base Strength, Predicting Acid – base Reactions from  $pK_a$  Values, Organic Acids and Organic bases, The Lewis Definition, Molecular Models. Noncovalent Interaction.
- 3. Alkanes and Their Stereochemistry:** Functional Groups, Alkane and Isomers, Naming Alkanes, Properties of Alkanes, Conformation of Ethane, Conformations of Other Alkane..
- 4. Cycloalkanes and Their Stereochemistry:** Naming Cycloalkanes, Cis- Trans Isomerism in Cycloalkanes, Conformations of cycloalkanes, Axial and Equatorial bonds in cycloalkane, Conformational Monosubstituted Cycloalkanes, Conformational Disubstituted Cycloalkanes, Conformations of Polycyclic cyclohexanes.
- 5. An Overview of Organic Reactions:** Kinds of organic reactions, How organic reaction occur, Mechanisms, Radical reactions, Polar reaction, Using curved Arrows in polar reactions Mechanisms, Describing a Reaction (Intermediates).
- 6. Alkenes:** Structure and Reactivity, Industrial Preparation and Use of Alkenes, Calculating Degree of Unsaturation, Naming Alkenes, Sequence Rules: E, Z Designation Stability of Alkenes, Electrophilic Addition Reactions of Alkenes, Orientation of Electrophilic Additions: Markovnikov's rule, Carbocation Structure and Stability, The Hammond Postulate, Evidence for the Mechanism of Electrophilic Additions, Carbocations Rearrangements.
- 7. Reactions and Synthesis of Alkenes;** Preparations of alkenes; A Preview of Elimination Reactions, Addition of Halogens to Alkenes, Addition of Hypohalous Acids of Alkenes. Addition of water to alkenes (Oxy-mercuration, hydroboration), Addition of Carbenes to alkenes, Reduction of Alkenes, Oxidation of Alkenes (Epoxidation, Cleavage to carbonyl Compounds), Radical Additions to Alkenes; Biological Addition of Radicals to alkenes.
- 8. Alkynes:** Naming Alkynes, Preparation of alkynes, (Elimination Reactions of Dihalides); Reactions of Alkyne (Addition of HX and  $X_2$ ); Hydration of Alkynes); Reduction of Alkynes; Oxidative Cleavage of alkynes: Alkyne Acidity (Formation of Acetylide Anions); Alkylation of Acetylide Anions, An Introduction of Organic Synthesis.
- 9. Organohalids:** Naming alkyl halides, Structure of Alkylhalides, Preparing of Alkyl Halides from Alkanes (Radical Halogenations), Preparation of Alkylhalides from Alkenes (Allylic Bromination), Stability of the Allyl Radicals, Preparation of Alkyl Halide from Alcohols, Reactions of Alkyl Halides (Grignard Reagents), Organometallic Coupling Reactions, Oxidation and Reduction in Organic Chemistry.
- 10. Benzene and aromaticity:** Names of aromatic hydrocarbons, Disubstituted benzenes, Structure and stability of benzene, Molecular orbital description of benzene, Aromaticity and Huckel  $4n+2$  rule, Aromatic heterocycles
- 11. Chemistry of Benzene:** Brominating of Aromatic Rings, Other Aromatic Substitutions, and Alkylation of Aromatic Rings: The Friedel–Crafts Reaction, Acylation of Aromatic Rings,



Substituent Effects in Aromatic Rings, An Explanation of Substituent Effects. Tri-substituted Benzenes: Additivity of Effects, Nucleophilic Aromatic Substitution, Benzene, Oxidation of Aromatic Compounds, Reduction of Aromatic Compounds, Synthesis Strategies.

**b. Practical:**

Laboratory Instructions and Safety: Laboratory instructions and the laboratory rules, Common Laboratory Techniques: Filtration, Decolonization, Drying and drying agents, Reflux, Reporting results, Identification of Organic Compounds; Physical Character, Solubility, Melting Points, Boiling Points. (Physical Properties). Re-crystallization. Extraction of Known mixture, Chromatography (Thin Layer Chromatography), Distillation Identification of Aromatic and aliphatic hydrocarbons, Detection Elements in Organic Compounds, Identifications and Classification of alcohol (primary, secondary, tertiary alcohols), Identification and Classification of Phenols, Identification and Classification of aldehydes and ketones, Identification and Classification of carboxylic acids and Esters, Identification and Classification of amines and nitro Compounds.

**D. Exams & Grading System**

The semi-official dates of the exams for this course, with all the caveats, that the word “semi-official” entails, can be found here:

- **Midterm 1:** 6<sup>th</sup> or 7<sup>th</sup> week & **Midterm 2:** 11<sup>th</sup> or 12<sup>th</sup> week
- **Quizzes & Homeworks: During the semester**

Your course grade will be based on Final Exam, Midterms, Homework, Quizzes, Participation, Attendance and Project.

<b>Midterm 1:</b> 10 %	<b>Midterm 2:</b> 10 %	<b>Final Exam:</b> 40 %
<b>Laboratory:</b> 30 %		<b>Quizzes; Homework &amp; Attendance &amp; Participation:</b> 10 %

**Grading distribution:**

A<sup>+</sup>: [95, 100], A: [90, 95), B<sup>+</sup>: [85, 90), B: [80, 85), C<sup>+</sup>: [75, 80), C: [70, 75), D<sup>+</sup>: [65, 70), D: [60, 65), F: [0, 60).



### E. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. (“Immediate family” is defined by the University as spouse, grandparents, parents, brother, or sister).
- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

[Executive Rules for Study Regulations and Examsgoo.gl/ykm7t3](https://www.examsgoo.gl/ykm7t3)

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