

## School of pharmacy

### Department Medicinal Chemistry

Course title: Organic Chemistry I

Credit (Theory or Practical): 3 Credits (Theory)

*Prerequisite:* General Chemistry

Course Lecturers: Dr. Mirfazli, Dr. Daneshmehr, Dr. Mahboubi-Rabbani

Responsible Lecturer: Dr. Mirfazli

### Course Description:

#### - Course objectives:

This course is designed to provide a fundamental overview of organic chemistry to students interested in pursuing a career in the sciences. Upon successful completion of this class, students will understand the relationship between structure and function of molecules, the major classes of reactions, reaction energetics and mechanisms, synthesis of organic compounds. As one of the Natural Sciences, chemistry has evolved out of careful observation and experimentation; as technology evolves, so does the body of chemical knowledge. This course will integrate relevant technological advances and their impact in the formulation of chemical principles and their applications. Furthermore, the laboratory component of the course will help to illustrate and apply some of these technological advances.

Organic chemistry provides the student with the necessary background to understand the chemistry of carbon-containing compounds. Topics will include structure, stereochemistry, nomenclature, synthesis, properties, and reactions of the major classes of organic compounds. A non-mathematical, mechanistic approach is used in the course to explain the reactions of these compounds.

The course consists of several interactive lectures about the organic compound synthesis.

#### Student Learning Objectives:

1. Analyze the structure of organic compounds by recognizing main functional groups, naming the compounds using the I.U.P.A.C. system, and predicting their properties using the type of bonding, hybridization state, intermolecular forces and stereochemistry;
2. Describe mechanisms of reactions: free radical, nucleophilic substitution, elimination and electrophilic addition, and apply this knowledge to predict the major product in organic reactions, such as those involving hydrocarbons, alcohols, alkyl halides, and alkenes;

3. Analyze the nature of a reagent: as a nucleophile, free radical, or electrophile and use this knowledge to propose the synthesis of organic compounds, such as a hydrocarbon, alkyl halides, alcohols, or alkenes; and
4. Demonstrate proficiency in organic laboratory skills as they pertain to: chemical information, safe handling, use and disposal of organic compounds; synthetic procedures, including isolation, purification, and use of instrumentation.

This course will require the student to integrate information, solve problems and engage in authentic inquiry to achieve these ends.

**Students are expected to:**

1. Recognize main functional groups in organic compounds;
2. Name organic compounds using the I.U.P.A.C. system;
3. Analyze the structure of a given compound and predict the type of bonding, hybridization state, and effect of the structure on the physical properties of such a compound;
4. Recognize nucleophiles, electrophiles and their reactivity, in order to predict the course of a reaction;
5. Write and understand mechanisms for the different types of organic reactions: free radical, nucleophilic substitution, elimination, and electrophilic addition;
6. Predict the major product in an organic reaction, such as those involving hydrocarbons, alcohols, alkyl halides, and alkenes, by applying the knowledge of reaction mechanisms;
7. Write a scheme for the synthesis of different classes of organic compounds, such as hydrocarbons, alcohols, alkyl halides, and alkenes;
8. Construct models of all the important classes of compounds, and predict their optical and structural isomers;
9. Standardize and operate laboratory instruments to identify reactants and products and to separate mixtures of compounds;
10. Obtain information about chemical compounds from all possible reference sources; apply this information for the safe handling, use and disposal of such compounds in a safe and environmentally responsible manner;
11. Work as a member of a team in solving classroom problems and in the laboratory;
12. Use appropriate current technology in the laboratory to obtain data; and
13. Understand the impact that recent technology has on the field.

## Organic Chemistry I Course Plan (M-Pharm)

### Saturday and Wednesday 10-12

	Subject	Learning activities/ assignment	Lecturer	Date
1	Atomic Structure, Chemical Bonds, Hybrid Orbitals	Participation in class discussions and asking own questions. Work on assignments.	Dr. Mirfazli	15 Feb.
2	Hybridization, Molecular Orbital Theory		Dr. Mirfazli	22 Feb.
3	Electronegativity, Dipole Moments		Dr. Mirfazli	25 Feb.
4	Alkanes, Naming, Properties		Dr. Mirfazli	1 Mar.
5	Kinds of Organic Reactions: Mechanisms		Dr. Mirfazli	4 Mar.
6	Radical Reactions		Dr. Mirfazli	11 Mar.
7	Energy Diagrams and Transition States		Dr. Mirfazli	15 Mar.
8	Cycloalkanes, Conformations of Cycloalkanes		Dr. Mirfazli	18 Mar
9	Cycloalkanes, Conformations of Cycloalkanes		Dr. Mirfazli	5 Apr.
10	Stereochemistry		Dr. Mirfazli	8 Apr.
11	Problem solving		Dr. Mirfazli	15 Apr.
12	<b>Exam (1-11)</b>		Dr. Mirfazli	19 Apr.
13	Alkenes, Naming Alkenes		Dr. Mirfazli	26 Apr.
14	Electrophilic Addition Reactions of Alkenes		Dr. Mirfazli	29 Apr.
15	Carbocation Structure		Dr. Mirfazli	3 May
16	Halohydrins from Alkenes		Dr. Mirfazli	6 May
17	Reduction of Alkenes		Dr. Mirfazli	10 May
18	Problem solving		Dr. Mirfazli	13 May
19	Alkyne naming and reaction		Dr. Daneshmehr	17 May
20	Names and Properties of Alkyl Halides		Dr. Daneshmehr	20 May
21	Reactions of Alkyl Halides, the SN2 Reaction, The SN1 Reaction		Dr. Daneshmehr	24 May
22	The SN2 Reaction, The SN1 Reaction		Dr. Daneshmehr	27 May
23	Elimination Reactions		Dr. Daneshmehr	31 May
24	Problem solving		Dr. Daneshmehr	3 Jun.
25	Benzene and Aromaticity		Dr. Daneshmehr	7 Jun.
26	Benzene and Aromaticity		Dr. Daneshmehr	10 Jun.
27	Electrophilic Aromatic Substitution Reactions		Dr. Daneshmehr	14 Jun.

28	Electrophilic Aromatic Substitution Reactions		Dr. Daneshmehr	17 Jun.
29	Problem solving		Dr. Daneshmehr	21 Jun.

### References:

- 1- Mc. Murry, J. Organic Chemistry, 8<sup>th</sup> ed., Books/cole Publishing Company; 2012.
- 2- Wade, L.G. Organic Chemistry; 8<sup>th</sup> ed.; Prentice- Hall Inc.; 2013.
- 3- Morrison, R.T.; Boyd, R.N. Organic Chemistry; 6<sup>th</sup> ed.; Prentice Hall; 1992.
- 4- Solomons, T.W.G. Organic Chemistry; 5<sup>th</sup> ed.; John Wiley and Sons Inc.; 1992.
- 5- Volhardt, K.P.C. Organic Chemistry; Wh Freeman; 2006.

### Assessment Methods for Course Learning Goals

Contents	Lecturer	Score
Class exercises, Midterm Exam (1-11)	Dr Mirfazli	7.85
Class exercises, final exam (12-29)	Dr Mirfazli Dr. Daneshmehr	12.15