Detailed Course Description - Course Plan Development and Updating Procedures/ Pharmacy Department	QF02/0408-3.0E

Faculty	Pharmacy	Department	Pharmacy
Course number	0201216	Course title	Pharmaceutical Organic Chemistry II
Number of credit hours	3	Pre-requisite/co-requisite	Pharmaceutical Organic Chemistry I

Brief course description

This course explores the understanding of structure and chemical transformations of organic molecules. It identifies and names the functional groups in molecules and explains their reactivity. It assists students to define a possible scheme for compound's synthesis. It addresses basic concepts of electronic structure and applies these concepts to solve problems from various areas of organic chemistry, including reactivity patterns and synthesis.

	Course goals and learning outcomes
Goal 1	To earn a general knowledge of the properties, and reactivity of different classes of organic compounds and the IUPAC nomenclature of representative organic compounds.
Learning outcomes	1.1 Explain the main physical and chemical properties of organic compounds, and the effect of electron donating groups, and electron with drawing groups on these properties. 1.2 Recognize the main differences between aliphatic, cyclic, heterocyclic and aromatic systems. 1.3 Recognize many functional groups and their reactivity, and the priority of the precedence in the IUPAC nomenclature of multi-functional compounds.
Goal 2	To predict the outcome of organic reactions, when given substrates and reagents, and provide reasonable mechanisms for organic reactions and their intermediates.
Learning outcomes	2.1 Recognize the reaction mechanisms, explain and draw the mechanistic pathway of chemical reactions. 2.2 Identify and differentiate conditions for nucleophilic substitution versus nucleophilic addition and electrophilic substitution reactions 2.3 Assign the appropriate reagents for chemical reactions.
Goal 3	To gain an informed view of, organic compounds synthesis, converting starting materials to desired products, and the resonance structures of compounds.
Learning outcomes	3.1 Recognize many fundamental bond forming reactions and how to apply them in synthesis 3.2 Understand and apply the concept of protecting groups 3.3. Draw the resonance structures of compounds and use them to explain stability, acidity, basicity, and reactivity of the compounds.

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Textbook	Organic Chemistry, T.W.G. Solomons & C.B.Fryhle, John Wiley & Sons, 10th edition.
Supplementary references	1. Organic Chemistry By Morrison & Boyd, 6th Edition. 2. Organic Chemistry By McMurry, 7th Edition

Course timeline

Week	Number of hours	Course topics	Pages (textbook)	Notes
01	**3**	**Ethers and Epoxides** - **Ethers** a. Structure b. Nomenclature c. Physical properties - **Preparations of Ethers** Williamson synthesis - **Reaction of Ethers** Cleavage by strong acids - **Epoxides** a. Structure b. Nomenclature of epoxides **Preparation of Epoxides: Epoxidation** a. **Epoxidation reaction** b. **Reaction of epoxide with Grignard reagent**	**11**	
02	**3**	**Aromatic Compounds, Aromaticity and Reactions of Aromatic Compounds** a. Introduction , nomenclature of benzene derivatives b. Kekule's Structure of benzene and stability of benzene c. Aromaticity and Huckel's rule. d. Other polycyclic aromatic compounds	**14**	
03	**3**	**Reactions of Aromatic Compounds** a. Electrophilic aromatic substitution reactions- Mechanism b. Effect of substitutions on reactivity and orientation of substitution, theory of orientation. c. Synthetic applications	**15**	
04	**3**	**Phenols** a. Structure and nomenclature of other derivatives, physical properties b. Synthesis of phenols	**21**	**Ref. 1 & 2**

		c. Reactions of phenols as Acids		
05	**3**	**Aldehydes and Ketones** a. Nomenclature b. Physical properties c. Synthesis of aldehydes and ketones - **Reactions of Aldehydes and Ketones** a. Mechanism of nucleophilic addition to C=O. b. The Addition of HCN	**16**	**Ref. 1 & 2**
06	**3**	c. The addition of ylides (Wittig reaction). d. The addition of organometallic reagents. e. The addition of alcohols: hemiacetals and acetals. f. The addition of primary and secondary amines. g. Oxidation & Reduction of Aldehydes and ketones.	**16**	**Ref. 1 & 2**
07	**3**	**Reactions at the α-H of carbonyl compounds, Condensation and Conjugate addition reactions of carbonyl compounds.** a. The acidity of the α-H of carbonyl compounds Reactions *via* enols and enolate anions b. Aldol reactions (without crossed Aldol reactions) c. Cyclizations *via* Aldol	**18+19**	**Ref. 1 & 2**
08	**3**	d. Addition to α, β-unsaturated aldehydes and ketones **Carboxylic Acids and Their Derivatives, Nucleophilic Addition-Elimination at the Acyl Carbon** a. Nomenclature	**17+18**	**Ref. 1 & 2**
09	**3**	b. Physical properties c. Preparation of carboxylic acids d. Nucleophilic addition – elimination at the acyl carbon	**17**	**Ref. 1 & 2**
10	**3**	- Relative reactivity of acyl compounds a. Acyl chlorides b. carboxylic acid anhydrides	**17**	
11	**3**	c. esters d. amides e. nitriles	**17**	

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12	**3**	**Amines** a. Nomenclature (one system) and physical properties b. Basicity of amines c. Synthesis of amines	**20**	**Ref. 1 & 2**
13	**3**	a. Reactions of amines, b. Reactions with nitrous acid. c. Replacement reactions of arenediazonium salts.	**20**	**Ref. 1 & 2**
14	**3**	d. Coupling reactions of arenediazonium salts e. Reaction of amines with sulfonyl chloride. f. Sulfa drugs-synthesis		**Ref. 1 & 2**
15	**3**	**Heterocycilic compounds** a. Five-membered ring systems and Six-membered ring systems-nomenclature b. Aromaticity and structure		
16	**3**	c. Simple examples of electrophilic substitution reactions d. Definition of the Fused rings: Indole, Benzofuran, Benzothiopheme, Quinoline and Isoquinoline		

Theoretical course evaluation methods and weight	First exam 25% Second exam 25% Final exam 50%

Approved by head of department		**Date of approval**	

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Extra information (to be updated every semester by corresponding faculty member)

Name of teacher	Eveen Al-Shalabi	Office Number	**229**
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