



Course Detailed Description – Procedures of the Course Plan Committee /Faculty of Pharmacy

QF02/0408–2.1E

Department	Pharmacy
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<b>Course Name</b>	<b>Pharmaceutical Organic Chemistry (1)</b>	<b>Course No.</b>	<b>0201112</b>
Prerequisite	<b>General Chemistry</b>	Credit Hours	<b>3</b>
Number & date of course plan approval		Brief Description	See form QF02/0409

<b>Course Objective</b>	The objective of the course is to provide the students with the necessary knowledge and experience to identify the functional groups of organic compounds, and to be able to determine their physical properties and chemical reactivities.
<b>Intended Learning Outcomes</b>	<ol style="list-style-type: none"> <li>1. Recognize the various functions groups or compound types in organic chemistry.</li> <li>2. Organize organic structures by reference to organic nomenclature</li> <li>3. Predict the chemical and physical properties of the compounds from its structure.</li> <li>4. Identify and apply typical and characteristic reactions of organic functional groups.</li> <li>5. Identify the likely organic reaction mechanisms.</li> <li>6. Identify the absolute configuration of the organic compounds.</li> </ol>
<b>Course Topics</b>	This course involves the bases of organic chemistry that include methods of preparation and reactions of alkanes, cycloalkanes, alkyl halides, unsaturated compounds (alkenes & alkynes), alcohols and thiols.
<b>Text Books</b>	Organic Chemistry, T.W.G. Solomons & C.B. Fryhle, John Wiley & Sons, 10 <sup>th</sup> edition.
<b>References</b>	Organic Chemistry by J. McMurry, 8 <sup>th</sup> Edition.
<b>Grade Determination</b>	<p>1<sup>st</sup> Exam = 25%</p> <p>2<sup>nd</sup> Exam = 25%</p> <p>Final Exam = 50%</p>

Course Outline				
Week	hours	Subjects	Chapters in Textbook	Notes
1	1	<b>The Basics:</b> Definition of organic chemistry, representation of structural formulas.	1	
	1	Chemical formulas and isomers, chemical bonds: ionic and covalent bonds.		
	1	Formal charge and resonance, hybridization, sigma and pi-bonds.		
2	1	<b>Families of Carbon Compounds:</b> Classification of organic compounds according to functional groups.	2	
	1	Intermolecular forces.		
	1	Physical properties and molecular structure		
3	1	<b>An Introduction to Organic Reactions and Their Mechanisms:</b> Acid-base reactions, and their mechanism. Lewis acids and bases.	3	
	1	Homolysis and heterolysis of covalent bonds K <sub>a</sub> and pK <sub>a</sub>		
	1	How to predict the outcome of acid-base reactions, relationships between structure and acidity.		
4	1	<b>Nomenclature and conformations of alkane and cycloalkanes:</b> Classification of hydrocarbons, shapes of alkanes.	4	
	1	IUPAC nomenclatures of alkanes, cycloalkanes, bicyclic alkanes, alkyl halides.		
	1	Physical properties.		
5	1	Sigma bonds and bond rotation, conformations of ethane and butane.	4	
	1	Relative stabilities of cycloalkanes, conformations of cycloalkanes and substituted cycloalkanes, cis-trans isomerism.		
	1	Reactions of alkanes: a- halogenation. b- combustion		

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6	1	Preparations of alkane: a- from alkenes b- from alkyl halides	4	
	1	<b>Stereochemistry:</b> chirality and stereochemistry. Isomerism: constitutional isomers and stereoisomers.	5	
	1	Enantiomers and chiral molecules, test for chirality and nomenclature of enantiomers (R, S system).		
7	1	Naming of enantiomers, and Properties of enantiomers: optical activity.	5	
	1	Fischer Projection Formulas. Diastereomers and meso compounds.		
	1	Stereoisomerism of cyclic compounds. Separation of enantiomers		
8	1	<b>Ionic reactions:</b> Nucleophilic Substitution and Elimination Reactions of Alkyl Halides. Organic halides, Nucleophilic substitutions, Nucleophiles, Leaving groups	6	
	1	Kinetics of a Nucleophilic Substitution Reaction: S <sub>N</sub> 2 Reaction Mechanism for S <sub>N</sub> 2 reaction Transition state theory: free energy diagrams.		
	1	The stereochemistry of S <sub>N</sub> 2 reactions S <sub>N</sub> 1 reaction, mechanism for S <sub>N</sub> 1 Carbocation.		
9	1	The stereochemistry for S <sub>N</sub> 1 reaction. Factors affecting the rate of S <sub>N</sub> 2 and S <sub>N</sub> 1 reactions.	6	
	1	Organic synthesis: functional group transformations using S <sub>N</sub> 2 reaction.		
	1	Elimination reactions of alkyl halides The E2 and E1 reactions. How to determine whether substitution or elimination is favored		
10	1	Organometallic compounds Preparation of organolithium and organomagnesium compounds, reaction of Grignard reagents.	6	

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	1	<b>Alkenes and Alkynes I:</b> Nomenclature of Alkenes, Cycloalkenes, and alkynes.	7 4	
	1	The <i>E-Z</i> System and cis-trans isomerism, relative stabilities of alkenes and Cycloalkenes	7 7	
11	1	Preparation of Alkenes: dehydrohalogenation of alkyl halides, dehydration of alcohols.	7	
	1	Carbocation stability and the occurrence of molecular rearrangements.		
	1	Preparation of Alkynes: Elimination Reactions, dehydrohalogenation of alkyl halides, reaction of metal acetylides with primary alkyl halides.		
12	1	<b>Alkenes and Alkynes II:</b> Electrophilic Addition hydrogen halides to alkenes: Mechanism and Markovnikov's rule.	8	
	1	Stereochemistry of the ionic addition to alkene. Addition of sulfuric acid to alkene, addition of water to alkenes: acid-catalyzed hydration.		
	1	Electrophilic addition of bromine and chlorine to alkenes, halohydrin formation. Oxidation of Alkenes: 1-Oxidation by cold $\text{KMnO}_4$ 2- Oxidation by hot $\text{KMnO}_4$ 3- Ozonolysis.		
13	1	Electrophilic addition of bromine and chlorine to alkyne, addition of hydrogen halides to alkynes, oxidative cleavage of Alkynes. Reduction of alkynes. How to plan a synthesis.	8	
	1	<b><u>Alcohols and Thiols:</u></b> <b>1. Alcohols</b> IUPAC nomenclature, structure & physical properties.	4+11	
	1	Preparation of Alcohols: From alkenes: (Hydration, Oxymercuration-demercuration, Hydroboration-oxidation, from alkyl halides with hydroxide anion.		



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14	1	Reactions of alcohols Alcohols as acids, conversion into mesylates and tosylates. Reactions with $\text{SOCl}_2$ and $\text{PX}_3$ .	12	
	1	<b>Alcohols From Carbonyl Compounds:</b> Structure of the carbonyl group. Oxidation-reduction reaction in organic chemistry Alcohols by reduction of carbonyl compounds		
	1	Oxidation of alcohols		
15	1	<b>2. Thiols</b> Synthesis from alkyl halide with SH anion.		
	1	Oxidation by $\text{I}_2$ or $\text{H}_2\text{O}_2$ .		
	1	Reaction as nucleophiles.		

Approved by Dept. Chair		Date of Approval	
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**Extra Information:** (Updated every semester and filled by course instructor)

<b>Course Instructor</b>	
<b>Office No.</b>	
<b>Extension Email</b>	
<b>Office hours</b>	