

Planning and Quality Assurance Affairs

Form (A)

Course Specifications

General Information

Course name	Organic Chemistry(2)
Course number	PHCH2306
Faculty	
Department	
Course type	Major Needs
Course level	2
Credit hours (theoretical)	3
Credit hours (practical)	0
Course Prerequisites	

Course Objectives

- 1 - develop an understanding and appreciation of both structure, synthesis and chemical transformations of advanced and more complicated organic molecules
- 2 - To bring the student to a good knowledge on structure and reactivity of the most important aromatic and hetero functional groups. 2] Students will acquire advanced concepts of structures and be able to apply them to solve problems from various areas of organic chemistry, including drug nomenclature, reactivity patterns and synthesis. Improvements in learning strategies, critical-thinking, and problem-solving skills are an expected outcome
- 3 - To provide a high level standard of education, establishing a broad knowledge base and experience in organic chemistry and its life applications
- 4 - Upon successful completion of this course the students can now demonstrate knowledge of the advanced concepts of pharmaceutical organic chemistry effectively which is expected to be used and helpful in the coming courses such as pharmaceutical chemistry, pharmacology and biochemistry

Intended Learning Outcomes

Knowledge and Understanding	<ul style="list-style-type: none">* define more advanced pharmaceutical organic chemistry especially ; aromatic and more complicated functional groups compounds such aldehydes, ketones, carboxylic acid and its derivatives, amines, heterocyclic chemistry and biomolecules as well as having a strong mentality towards poly functional nomenclature* define more advanced chemical reactions mechanisms and their applications in drug synthesis and medicinal organic agents. In addition to illustrate different potential interactions between organic molecules.* Information-retrieval skills, in relation to primary and secondary information sources, including on-line computer searches
Intellectual Skills	<ul style="list-style-type: none">* Apply the gained advanced informations to formulate and suggest the methods of synthesis and conclude properties of complicated medicinal agents
Professional Skills	<ul style="list-style-type: none">* Apply professional skills in synthesis and analysis of different pharmaceutical organic compounds* Writing down and discuss results and choosing and implementing perfectly the proper routes during practical work
General Skill	<ul style="list-style-type: none">* Communication skills, covering both written and oral communication* Information-retrieval skills, in relation to primary and secondary information sources, including on-line computer searches* Information-technology skills such as internet communication during using and browsing specific websites

Course Contents

- 1 - Week 1 :- (Benzene and Aromaticity) • The main criteria for aromaticity • Heterocycles and aromaticity • Effect of aromaticity on polarity • Effect of aromaticity on acidity • Effect of aromaticity on basicity • Inductive and mesomeric effects • Aromaticity in drugs (Aromatic containing drugs)
- 2 - Week 2:- (Reactions of benzene and aromatic compounds) • Electrophilic aromatic substitution • Nucleophilic aromatic substitution • Reactivity and Orientation • Oxidation of benzene • Reductions of benzene (Birch reduction) • Poly nuclear aromatic hydrocarbon synthesis (Naphthalene, Anthracene and Phenanthrene). • Drug synthesis including Electrophilic and nucleophilic aromatic substitution reactions
- 3 - Week 3-4:- (Aldehydes and Ketones) Nucleophilic Additions • Physical properties of aldehydes and ketones • Acidity of aldehydes and ketones (?-hydrogen acidity) • Preparation of aldehydes • Preparation of ketones • Feature of carbonyl group • Nucleophilic addition and Relative reactivity of aldehydes and ketones • Nucleophilic addition reactions a. With Water [Geminal diols] b. With HCN [Cyanohydrins formation] c. With Grignard reagent[Alcohol formation] d. With Alcohol [Hemi- and Acetal formation] e. With Primary amines [Imine formation] f. With Secondary amines[Enamine formation] g. With Hydrazine in acidic media [Hydrazone formation] h. With Hydrazine in basic media " Wolff-Kishner reaction [Alkane formation] i. With Hydroxylamine [Oxime formation] j. With Semicarbazide [Semicarbazone formation] k. With hydrides [Alcohol formation] l. With Phosphorous " Wittig Reaction" [alkene formation] m. With NaOH" Cannizzaro Reaction" [Disproportionation product] • Nucleophilic addition to α,β -unsaturated carbonyl groups • Some biological Nucleophilic addition reactions • Drug synthesis including Nucleophilic addition reactions • Aldehydes and ketones containing drugs
- 4 - Week 5:- (Carbonyl condensation reactions) • α -carbanions as nucleophiles • Self and mixed aldol condensation reactions • Intramolecular aldol condensation reactions • Self and mixed ester condensation [Claisen condensation] • Intramolecular Claisen condensations [Dieckmann Cyclization] • Biological carbonyl condensation • Drug synthesis including Nucleophilic addition reactions
- 5 - Week 6-7:- (Carboxylic acids and derivatives) • Physical properties of carboxylic acids • Substituent effects on acidity of carboxylic acids • Preparation of carboxylic acids a. Hydrolysis of nitriles b. Hydrolysis of esters c. Hydrolysis of amides d. Carboxylation of Grignard reagents e. Oxidation of alkyl benzene f. Oxidative cleavage of alkenes and alkynes g. Oxidation of primary alcohols • Reactions of carboxylic acids (Derivatives) a. Chemistry of esters (reactions and preparations) b. Chemistry of acid anhydrides (reactions and preparations) c. Chemistry of amides (reactions and preparations) d. Chemistry of acid halides (reactions and preparations) e. Chemistry of Nitriles (reactions and preparations) • Polyamides and polyesters [Chain-growth and step-growth polymers] • Biological carboxylic acids (thiol ester) • Drug containing carboxylic acids and derivatives
- 6 - Week 8:- (Carbonyl Alpha-Substitution Reactions) • Acidity of Alpha hydrogenatoms [Enolate ion formation] • Keto-enol Tautomerism • Alpha-Halogenation of ketones and aldehydes • Alpha-Halogenation of Carboxylic acids [Hell-Volhard-Zelinski reaction] • Halogenation of enolate ions[Haloform reactions] • Alkylation of enolate [Malonic ester alkylation] • Drug synthesis via carbonyl alpha-substitution reactions
- 7 - Week 9-10 (Aliphatic and aromatic amines) • Physical properties • Morphine alkaloids and rule • Amine basicity and relative basicity of aromatic and aliphatic amines • Preparation of aliphatic and aromatic amines a. S_N2 reactions of alkyl halides with amines b. Gabriel Synthesis c. Reduction of nitriles and amides using $LiAlH_4$ d. Reductive amination of aldehydes and ketones e. Hofmann and Curtius Rearrangements f. Reduction of nitro compounds • Reactions of Amines a. Alkylation b. Acylation c. Hofmann Elimination d. N-Oxidation e. Amines and sulfonamide [Sulfa drugs] f. Diazonium salts and Sandmeyer reaction g. Azo compounds and dyes • Amines containing drugs
- 8 - Week 11:- (Phenols) Physical properties [Solubility, antiseptic and disinfectant features] Phenols acidity. Preparation of phenols. Alkali fusion of aromatic sulfonates. Hydrolysis of arenediazonium salts. Reactions of phenols. Alcohol-like reactions [Nucleophilic substitutions and esterifications]. Electrophilic aromatic substitution [Kolbe-Schmitt Carboxylation]. Oxidation of phenols. Claisen rearrangement. Phenol containing drugs
- 9 - Week 12:- (Heterocycles and Nucleic acids) • Physical properties • Nomenclature of heterocycles • Preparation of heterocyclic rings a. Hantzsch Dihydropyridine (Pyridine) Synthesis b. Paal-Knorr Pyrrole Synthesis • Synthesis and mechanistic interpretation for several heterocyclic mono-ring and fused system among drug synthesis • Reactions of heterocycles a. Electrophilic aromatic substitutions for aromatics heterocycles b. Nucleophilic aromatic substitutions for aromatics heterocycles • Structure of DNA and base pairing
- 10 - Week 13-14:- Special topics Carbohydrates. α -Amino acids. Peptides. proteins. Lipids

Teaching and Learning Methods

- 1 - Tutorials and discussion
- 2 - learning video

Students Assessment

<u>Assessment Method</u>	<u>TIME</u>	<u>MARKS</u>
Midterm exam	week no 6	30%
quizzes and home work	distributed among the whole semester	20%
final exam	week no 14	50%

Books and References

Course note	lecture notes by the lecturer through collection of several books
Essential books	Organic Chemistry by John E. McMurry Organic Chemistry by Jonathan Clayden
Recommended books	Synthesis of Essential Drugs by R.S. Vardanyan and V.J. Hruby Writing Reaction Mechanisms in Organic Chemistry by Audrey Miller
Other References (Periodical, web sites, etc.)	www.khanacademy.org www.ochem.co