

Benghazi University
Faculty; Pharmacy
Department; Pharmaceutical chemistry

Course title; Organic Chemistry
Course Specifications;

Program on which the course is given;

Academic year / level; 2nd.year

Date of course specification approval;

1. Basic Information;

Title; Organic Chemistry II **Code;** **Credit hours ;**(4hours)

Lecture; (2hrs) **Tutorial;** (1hr-optional) **Practical;** (2hrs) **Total;** (4-5) hour/week

2. Course Objectives;

2.1. To provide a stronger background in organic chemical principles that is particularly important to organic chemistry and drugs molecules.

2.2. To develop an appreciation for the difficult task of judging the methods of experimental techniques ,synthesis, identification of different functional groups in organic and drugs molecules and how to sharpened it by the application of practical experiments.

2.3. To develop wide range of techniques that are useful in modern organic chemistry and using different tools such as spectroscopes methods. For identification organic molecules

2.4. To know how we can synthesis of different organic molecules related to drugs molecules and study their physical and chemical properties and reach their identifications by different methods "classical and modern".

2.5. To know the structure and properties of organic molecules which are considered as heart of drugs molecules such heterocyclic and other molecules and how deal with their reactions.

3. Intended Learning Outcomes (ILOs);

a. Knowledge and understanding;

a.1. Described different schemes for the chemical and physical properties with synthesis of the different organic molecules.

a.2. Describe different functional groups in organic molecule and their chemical reactions and how reaching building of different organic and drugs molecules through chemical synthesis.

a.3. Study principles and application of different tools to reach identification of organic and drugs molecules structures by using spectroscopy tools such as ($^1\text{H-NMR}$, $^{13}\text{CNMR}$, U.v, I.R and mass spectroscopy).

a.4. Describe the chemical and physical properties of the most important nucleus of drugs molecules such as various of heterocyclic rings.

b. Intellectual Skills;

b.1. Study of chemical and physical properties of different organic molecules as well as using different methods for their synthesis.

b.2. Select suitable methods for qualitative identification of structure of different organic molecules.

b.3. Evaluate the structures of organic molecules through the data of analysis.

c. Professional and practical Skills;

c.1. Apply the given schemes for identification of functional groups in drugs and organic molecules.

c.2. Design schemes for the synthesis and identification of different organic molecules that are drugs analogs.

d. General and Transferable Skills;

d.1. Integration of different field of knowledge.

d.2. Problem solving.

d.3. Team work.

d.4. independent learning.

4.A. Theory contents;

No	Topic	No. of hours
1.	<p>◆ Introduction to chemistry of aromatic compounds (including polynuclear aromatic).</p> <p>-Benzene: structure, stability, aromaticity (Hückel rule $4n+2$, antiaromaticity), classification, naming and structure of benzenoid & non benzenoid compounds, isomerism, isomerism in the substituted benzene, reaction, theory of electrophilic substitution reactions, substitution in benzene</p> <p>And polynuclear compounds, mechanism of electrophilic substitution and orientation.</p>	(10hrs)
2.	<p>◆ Organic spectrometry (spectrometric identification of organic compounds).</p> <p>NMR(nuclear magnetic resonance)</p> <p>(i) Proton NMR(3hrs)</p> <p>-Introduction, instrument and sample handling, chemical shift, spectrum, factors effecting chemical shift (Electro negativity, Hybridization, hyper conjugation, resonance and long range effect), coupling constant origin, vicinal, germinal, across coupling (sp^3, sp^2, cis, and trans), exchangeable proton chemical shift, chemical shift equivalence and magnetic equivalence, strongly and weak coupled systems, problems.</p> <p>(ii) C-13 NMR(2hrs)</p> <p>-Introduction type of spectra, decoupling, coupled spectra, off resonance, DEPT, chemical shift of different classes of compounds, problems.</p> <p>(iii) Infrared(IR) absorption (2hrs)</p> <p>-Introduction, types of vibrations and bonds, characteristic group absorption of organic molecules and interpretations of spectra for ; alkanes, alkenes, alkynes, aromatic, alcohols, phenols, ethers, aldehydes, ketones, carboxylic acids, esters, acid anhydrides, amides, amines, amine salts and nitriles.</p> <p>(iv) Ultraviolet (2hrs).</p> <p>-principle of absorption spectroscopy, introduction, theory, Lambert Beer's law, chromophore (Auxochrome, bathchromic shift, hypsochromic, hyperchromic and hypochromic shifts, determination of structure of an organic unknown, calculation λ of absorption of unsaturated compounds; Woodward and Fieser rules for dienes, Fieser and Kuhn rules for polyene, α, β-unsaturated carbonyl (ketones and aldehydes), α, β-unsaturated carboxylic acids and esters, aromatic compounds, and problems</p> <p>(v) Mass spectroscopy.(3hrs)</p> <p>-introduction, the mass spectrum, molecular formula determination (isotopic, rearrangement ions), fragmentation of hydrocarbon, alcohols, phenols, ethers, ketones, aldehydes, carboxylic acids, esters, amines, nitro compounds, problems, combined spectra problems.</p>	(16hrs)
3.	<p>◆ Chemistry of aromatic compounds</p> <p>--structure, nomenclature, physical properties, preparations (direct and indirect methods), and reaction.</p> <p>(i) Arenes (substituted benzenes and polynuclear compounds);</p>	(12hrs)

	<p>reactivity, oxidation, halogenations (aromatic ring and side chain).</p> <p>(ii) Carbonyl compounds (aldehydes and ketones). -Oxidation, addition on carbonyl group, electrophilic aromatic substitutions.</p> <p>(iii) Carboxylic acids (mono, dibasic) and their derivatives Acidity (salt formation), reduction, electrophilic aromatic substitutions, formation of acid derivatives (hydrolysis, ammonolysis, alcoholysis, dehydrolysis), reduction.</p> <p>(iv) Nitro compounds and amines -Nitration, reduction (and selectivity), protection, diazotization, synthesis of organic compounds.</p> <p>(v) Sulphonic acids -- Electrophilic aromatic substitutions. desulphonation, displacement of sulphonic group, electrophilic aromatic substitutions</p> <p>(vi) Phenols - Acid characters, esterification, ether formation,</p> <p>(vii) Halogenated compounds (ring and side chain). - reactivity, electrophilic aromatic substitutions, nucleophilic aromatic substitutions</p>	
4.	<p>Chemistry of heterocyclic compounds</p> <p>-structure, nomenclature (including IUPAC and trivial names), classification; saturated heterocyclic compounds, unsaturated heterocyclic compounds, chemical reactions and their properties such as behavior towards electrophilic and nucleophilic reagent, basic and acidic properties, oxidation, reduction and methods of synthesis of heterocyclic compounds, aromatic heterocyclic compounds, (five membered with one heteroatom (pyrrole, thiophene, furan), six membered ring with one heteroatom (pyridine), fused heterocyclic containing five membered ring (indole, benzothiophene, and benzofuran), fused heterocyclic containing six membered ring (quinoline and isoquinoline), Five membered ring with two heteroatoms (pyrazole, imidazole, oxazole, and thiazole), Six membered rings with two nitrogen atoms (pyrimidine, pyridazine, and pyrazine).</p>	<p>(12hrs)</p> <p>----- <i>Total</i> (50hrs)</p>

4. B. Practical contents;

<i>Organic Chemistry Experiments</i> Organic chemistry II Second Year Identification of organic compounds		
Topics	No. of hour (3hrs) for each laboratory	
<p>1. Introduction.</p> <p>2. Safety.</p> <p>3. Toxicity.</p> <p>4. Some common chemical poisons and the symptom they induce...</p> <p>5. First Aids.</p> <p>6. Regulation.</p> <p>7. Glass Ware and Apparatus.</p> <p>8. Physical properties of organic compounds.</p> <ul style="list-style-type: none">◆ (States; (Solid, liquid, Gas), Color, Odor, Density, refractive index,) <p>9. Dry heat</p> <ul style="list-style-type: none">◆ (urea, benzoic acid, glucose, chloral hydrate, sodium benzoate, aniline, carbon tetrachloride, potassium citrate) <p>10. Solubility</p> <ul style="list-style-type: none">◆ (any organic compounds represent the classes of functional groups) <p>11. Action of soda-lime and 30% NaOH</p> <ul style="list-style-type: none">◆ (Ammonium salt, acetamide, actanilide, tartaric acid, benzoic acid , glucose, aniline hydrochloride, chlorohydrate). <p>12. Action of $FeCl_3$ and conc. H_2SO_4(cold/hot)</p> <ul style="list-style-type: none">◆ Acid and their salts (tartaric, oxalic, acetic, benzoic), benzyl alcohol, phenol, and aniline). <p>13. determination of physical constant for organic compounds(b.p and m.p).</p> <ul style="list-style-type: none">◆ R examples; benzoic acid , aniline , actanilide, salicylic acid). <p>14. Detection of elements ; N,S,X, Examples;(acetamide, chloral hydrate, chloroform, urea, carbon tetrachloride)</p> <p>15. Qualitative identification of functional groups in organic compounds.</p> <ul style="list-style-type: none">◆ Alcohols.◆ Aldehydes and ketones.◆ Carboxylic acids (aliphatic and aromatic).◆ Salt of carboxylic acids.◆ Halogenated and higher fatty acids.◆ Phenols compounds.◆ Amines and amine salts.◆ Esters .◆ Amides.◆ Anilides .◆ Aromatic hydrocarbons .◆ Halogenated hydrocarbons.◆ Carbohydrates .		

◆ Amino acids.

5. Teaching and Learning Methods;

(All methods below can be used)

5.1. Presentation.

5.2. Data show.

5.3. Tutorial.

6. Student Assessment methods;

a. Assessment methods;

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| 1. MSQ Assessment | 1 | to assess information of 10 weeks study. |
| 2. MSQ Assessment | 2 | to assess information of 20 weeks study |

b. Assessment schedule;

Assessment 1	10 weeks
Assessment 2	20 weeks

c. Weighing of Assessments;

Assessment Examination:	40 marks/200
Final Examination;	120marks/200
Oral Examination	None
Practical Examination	40marks/200
Other types of examination	-----

200 marks Total 100%**7. List of References;**

No.	Reference	Type
	a1. Morrison and Boyd, Sixth Edition 1992 (Organic chemistry). (theory) a2. (Introduction to organic chemistry) by A. Streitwieser and C.H. Heathcock, 4 th .ed., 1992. (theory) b1. Pavia, Lampan and Kriz, ((Introduction to organic laboratory techniques)), 3 rd .ed., 1988. (Practical) b2. Practical organic chemistry, Vogel's 5 th .1989.(practical)	textbook
1.	a. Graham Solomon's Craig Fryhle,(organic chemistry)7 th .2002. (theory). b. Williamson K.L. and Fieser L.F Organic experiments 6 th . Ed. 1967. (Practical) c. Silverstein R.M , Bassler G.C, and Morrill T.C., Spectrometric, Identification of organic compounds ,1991 (Practical)	periodical

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