

Republic of Yemen

Ministry of Higher Education & Scientific Research

21 September University for Medicals and Applied Sciences



Faculty of Clinical Pharmacy

Bachelor of Clinical Pharmacy & Pharm. D.

Course Specification of **Pharmaceutical Organic Chemistry-II**

Course No. (02.04.245)

2022

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Prof. Ali G. Al-kaf	Prof.. Mukhtar Al-Gharafi Dr Sadeq Azzam	Dr. -----	Dr. Abdulelah Thabet	Dr. Ali Alyahawi

III. Course Intended Learning Outcomes (CILOs)		Referenced PILOs Learning out of program
A. Knowledge and Understanding: Upon successful completion of the course, students will be able to:		
a.1	Discuss the basic principles of Stereochemistry of organic compounds and know the stereochemistry of drugs and their application in pharmacy fields	A1
a.2	Describe the names, synthesis and chemical reactions of aromatic and heteroaromatic organic compounds including some synthetic drugs	A1, A2
B. Intellectual Skills: Upon successful completion of the course, students will be able to:		
b.1	Identify the stereochemistry of organic compounds and their important in activity of drugs	B1
b.2	Detect the difference between heteroaromatic and non-aromatic compounds or drugs in chemical reactions	B1, B2
C. Professional and Practical Skills: Upon successful completion of the course, students will be able to:		
c.1	Analyze the stereochemistry of organic compounds and their activity	C1
c.2	Synthesize and purify the newly synthesized chemical compounds or drugs	C1, C2
D. Transferable Skills: Upon successful completion of the course, students will be able to:		
d.1	Search and evaluate the literature from different sources including the library, internet Etc	D3

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1. Discuss the basic principles of Stereochemistry of organic compounds and know the stereochemistry of drugs and their application in pharmacy fields	Lecture, class discussions and software	Written examination

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Prof. Ali Alkaf	Dr. Abdulelah Thabet	Dr. -----	Dr. Abdulelah Thabet	Dr. Ali Alyahawi

a2 -Describe the names, synthesis and chemical reactions of aromatic and heteroaromatic organic compounds including some synthetic drugs.	Lecture and problem solving	Written examination and evaluation of problem solving
---	-----------------------------	---

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1- Identify the stereochemistry of organic compounds and their important in activity of drugs	Lecture, class discussion, problem solving, report, practical classes and reading assignment.	Written and oral examination, evaluation of report and micro assignment and problem.
b2- Detect the difference between heteroaromatic and non-aromatic compound or drugs in chemical reactions		

(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:

Professional and Practical skills	Teaching strategies	Assessment Strategies
c1- Analyze the stereochemistry of organic compounds and their activity	Practical classes, assignments Lecture, problem solving, and small group discussions	Written and oral examinations and evaluation of practical classes, problem solving
c2- Synthesize and Purify the newly synthesized chemical compounds or drugs	Assignments Lecture, problem solving, practical classes and small group discussions	Written and oral examinations and evaluation of practical classes, problem solving

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:

General and Transferable skills	Teaching strategies	Assessment Strategies
d1- Search and evaluate the literature from different sources including the library, internet etc.	Lecture, problem solving, practical classes and small group discussions, practical classes and small group discussions	Written and oral examinations and evaluation of practical classes, problem solving

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Prof. Ali Alkaf	Dr. Abdulelah Thabet	Dr. -----	Dr. Abdulelah Thabet	Dr. Ali Alyahawi

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	Introduction of aromatic chemistry	a1,a2 , b1,a2, c1, d1	- Definition of aromaticity. aromatic compounds classifications, Criteria of aromatic compound, Huckl' rule and properties of aromatic compounds. - Nomenclature of aromatic -The effect of aromaticity in stability and chemical properties of drugs	2	4
2	Reaction of aromatic compounds and Effect of substituent	a1,a2 , b1,a2,	- Halogenations - Nitration - Sulphonation - Friedel-Craft alkylation and acylation - Donating groups EDG and withdrawing groups EWG and their effect in the mechanism and the effect in the chemical properties of drugs	2	4
3	Phenol	a1,a2 , b1,a2, c2, d1	- Structure, acidity character, nomenclature, preparation , reaction and uses - The structure activity of phenol in drugs	1	2
4	Aryl halide	a1,a2 , b1,a2, c2, d1	- Nomenclature - Properties - Synthesis - Reaction - The structure activity of halide in the physical and chemical characters of drugs	1	2

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Prof. Ali Alkaf	Dr. Abdulelah Thabet	Dr. -----	Dr. Abdulelah Thabet	Dr. Ali Alyahawi

5	Midterm Exam	a1,a2 , b1,a2, c2, d1	-	1	2
6	Aldehyde and ketone	a1,a2 , b1,a2, c2, d1	- Structure, reactivity .nomenclature, preparation and reaction and their application in drug development	1	2
8	Carboxylic acid and its derivatives	a1,a2 , b1,a2, c2, d1	- Acidity - Nomenclature - synthesis - Reactions - The structure activity of carboxylic acid in the physical and chemical characters of drugs	1	2
10	Poly-aromatic hydrocarbons	a1,a2 , b1,a2, c1, c2, d1	- Naphthalene, anthracene - Phenanthrene - Pharmaceutical importance of polynuclear compounds	3	6
11	Five membered heterocyclic and Six membered heterocyclic	a1,a2 , b1,a2, c2, d1	- Nomenclature IUPAC, preparations and reactions, - Pharmaceutical importance of heterocyclic	2	4
12	Final Exam	a1,a2 , b1,a2, c2, d1		1	2
Number of Weeks /and Units Per Semester				16	32

B - Practical Aspect: (if any)				
Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1	Synthesis of aspirin	1	2	All ILOs
2	Preparation of soap	1	2	All ILOs
3	Prepare phenyl-azo-B-naphthol	1	2	All ILOs
4	Preparation of acetanilide	1	2	All ILOs
5	Nitration of acetanilide	1	2	All ILOs

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Prof. Ali Alkaf	Dr. Abdulelah Thabet	Dr. -----	Dr. Abdulelah Thabet	Dr. Ali Alyahawi

6	Preparation of methyl salicylate	1	2	All ILOs
7	Preparation of penta-O-acetyl-glucose	1	2	All ILOs
8	Preparation of paracetamol	1	2	All ILOs
9	Preparation of di-nitro-phenol	1	2	All ILOs
10	Preparation of isopropyl acetate	1	2	All ILOs
11	Preparation of phenyl urea and 1,3-diphenylurea	1	2	All ILOs
12	Preparation of methyl benzoate	1	2	All ILOs
12	Extraction of caffeine from leaves tea	1	2	All ILOs
Number of Weeks /and Units Per Semester		14	28	

V. Teaching strategies of the course:

- Lectures
- Small group discussion sessions
- problem solving methods
- presentations

VI. Assignments:

No	Assignments	Aligned CILOs (symbols)	Week Due	Mark
1	One home assignment after each lecture	a1, a2, b1, b2, c1, d1, d1	Week 3-14	5
2	Group assignment	a1, a2, b1, c1, d1	Week 7, 14	5
Total				10

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Prof. Ali Alkaf	Dr. Abdulelah Thabet	Dr. -----	Dr. Abdulelah Thabet	Dr. Ali Alyahawi

VII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Assignments	Week 3-14	10	10%	All ILOs
2	Midterm Exam	8	20	20%	All ILOs
3	Practical Exam	12	20	20%	All ILOs
4	Final Exam	16	50	50%	All ILOs
Total			100	100%	

VIII. Learning Resources

1. Required Textbook(s) (maximum two).

- T. W. Graham Solomons (2008). Organic Chemistry, 9th ed., John Wiley and Sons, Inc. New York .
- Furniss, Hannaford, Smith, Tatchell (1989). Vogel's textbook of Practical Organic Chemistry, 5th ed., Longman Group UK Ltd, England.

2. Essential References.

- Jerry March (1992). Advanced Organic Chemistry, Reactions, Mechanisms, and structure, 4th ed, John Wiley and Sons, Inc., New York.

3. Electronic Materials and Web Sites etc.

Nil

IX. Course Policies:

1	Class Attendance: Class Attendance is mandatory. A student is considered absent and shall be banned from taking the final exam if his/her absence exceeds 25% of total classes.
2	Tardy: A student will be considered late if he/she is not in class after 10 minutes of the start time of class.
3	Exam Attendance/Punctuality: No student shall be allowed to the exam hall after 30 minutes of the start time and shall not leave the hall before half of the exam time has passed.
4	Assignments & Projects:

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Prof. Ali Alkaf	Dr. Abdulelah Thabet	Dr. -----	Dr. Abdulelah Thabet	Dr. Ali Alyahawi

	Assignments and projects must be submitted on time. Students who delay their assignments or projects shall lose the mark allocated for the same.
5	Cheating: Cheating is an act of fraud that results in the cancelation of the student's exam or assignment. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
6	Forgery and Impersonation: Forgery/Impersonation is an act of fraud that results in the cancelation of the student's exam, assignment or project. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
7	Other policies: The University official regulations in force will be strictly observed and students shall comply with all rules and regulations of the examination set by the Department, Faculty and University Administration.

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Prof. Ali Alkaf	Dr. Abdulelah Thabet	Dr. -----	Dr. Abdulelah Thabet	Dr. Ali Alyahawi

Faculty of Clinical Pharmacy

Bachelor of Clinical Pharmacy & Pharm. D.

Course Plan (Syllabus) of Pharmaceutical Organic Chemistry-II Course No. (02.04.245)

I. Information about Faculty Member Responsible for the Course:						
Name of Faculty Member:		Office Hours				
Location & Telephone No.:						
E-mail:		SAT	SUN	MON	TUE	WED THU

2022- 2023

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Prof. Ali Alkaf	Dr. Abdulelah Thabet	Dr. -----	Dr. Abdulelah Thabet	Dr. Ali Alyahawi

II. Course Identification and General Information:

1.	Course Title:	Pharmaceutical Organic Chemistry-II				
2.	Course Code:	02.04.245				
3.	Credit Hours:	Credit Hours	Theory Contact Hours		Practical Contact Hours	
			Lecture	Tutorial/Seminar	Lab	Clinical
		3	2		2	--
4.	Level/ Semester at which this Course is offered:	2 nd Level /2 nd Semester				
5.	Pre –Requisite (if any):	Pharmaceutical Organic Chemistry-I				
6.	Co –Requisite (if any):					
7.	Program (s) in which the Course is Offered:	Bachelor of Clinical Pharmacy & Pharm. D.				
8.	Language of Teaching the Course:	English				
9.	Location of Teaching the Course:	Faculty of Clinical Pharmacy				
10.	Prepared by:	Full Time				
11.	Date and Number of Approval by Council:					

III. Course Description:

This course provides students with the fundamental knowledge of stereochemistry and aromatic compounds including the nomenclatures, properties, synthesis, chemical reactions, and the pharmaceutical application of these compounds. The practical part includes the preparation of some aromatic compounds.

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Prof. Ali Alkaf	Dr. Abdulelah Thabet	Dr. -----	Dr. Abdulelah Thabet	Dr. Ali Alyahawi

IV. Course Intended Learning Outcomes (CILOs) :

Upon successful completion of the Course, student will be able to:

A. Knowledge and Understanding:

a1	Discuss the basic principles of Stereochemistry of organic compounds and know the stereochemistry of drugs and their application in pharmacy fields
a2	Describe the names, synthesis and chemical reactions of aromatic and heteroaromatic organic compounds including some synthetic drugs

B. Intellectual Skills:

b1	Identify the stereochemistry of organic compounds and their important in activity of drugs
b2	Detect the difference between heteroaromatic and non-aromatic compounds or drugs in chemical reactions

C. Professional and Practical Skills:

c1	Analyze the stereochemistry of organic compounds and their activity
c2	Synthesize and purify the newly synthesized chemical compounds or drugs

D. Transferable Skills:

d2	Search and evaluate the literature from different sources including the library, internet Etc
d3	

V. Course Contents:

A. Theoretical Aspect:

Order	Units/Topics List	Sub Topics List	Number of Weeks	contact hours
1	Introduction of aromatic chemistry	- Definition of aromaticity. aromatic compounds classifications, Criteria of aromatic compound, Huckl' rule and properties of aromatic	2	4

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Prof. Ali Alkaf	Dr. Abdulelah Thabet	Dr. -----	Dr. Abdulelah Thabet	Dr. Ali Alyahawi

		compounds. - Nomenclature of aromatic - The effect of aromaticity in stability and chemical properties of drugs		
2	Reaction of aromatic compounds and Effect of substituent	- Halogenations - Nitration - Sulphonation - Friedel-Craft alkylation and acylation - Donating groups EDG and withdrawing groups EWG and their effect in the mechanism and the effect in the chemical properties of drugs	2	4
3	Phenol	- Structure, acidity character, nomenclature, preparation , reaction and uses - The structure activity of phenol in drugs	1	2
4	Aryl halide	- Nomenclature - Properties - Synthesis - Reaction - The structure activity of halide in the physical and chemical characters of drugs	1	2
5	Midterm Exam	-	1	2
6	Aldehyde and ketone	- Structure, reactivity, nomenclature, preparation and reaction and their application in drug development	1	2

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Prof. Ali Alkaf	Dr. Abdulelah Thabet	Dr. -----	Dr. Abdulelah Thabet	Dr. Ali Alyahawi

8	Carboxylic acid and its derivatives	- Acidity - Nomenclature - synthesis - Reactions - The structure activity of carboxylic acid in the physical and chemical characters of drugs	1	2
10	Poly-aromatic hydrocarbons	- Naphthalene, anthracene - Phenanthrene - Pharmaceutical importance of polynuclear compounds	3	6
11	Five membered heterocyclic and Six membered heterocyclic	- Nomenclature IUPAC, preparations and reactions, - Pharmaceutical importance of heterocyclic	2	4
12	Final Exam		1	2
Number of Weeks /and Units Per Semester			16	32

B. Case Studies and Practical Aspect:

VI. Teaching Strategies of the Course:

- Lecture
- Instructor – student Interactive
- Exercises
- Presentation
- Office hours
- Seminar
- Assignment
- Self-Learning

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Prof. Ali Alkaf	Dr. Abdulelah Thabet	Dr. -----	Dr. Abdulelah Thabet	Dr. Ali Alyahawi

VII. Assessment Methods of the Course:

- Assignments
- Quiz
- Exam
- Oral Presentation

VIII. Assignments:

IX. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Assignments	6th, 12th	10	10%	
2	Practical Reports	2 nd -13 th	5	5%	
3	Midterm Exam (Theory)	Week 7	15	15%	
	Midterm Exam (Practical)	Week 7	10	10%	
4	Final Practical Exam	14 th	10	10%	
5	Final Exam (Theory)	Week 16	50	50%	
Total			100	100%	

X. Learning Resources:

1. Required Textbook(s) (maximum two).

- T. W. Graham Solomons (2008). Organic Chemistry, 9th ed., John Wiley and Sons, Inc. New York .
- Furniss, Hannaford, Smith, Tatchell (1989). Vogel's textbook of Practical Organic Chemistry, 5th ed., Longman Group UK Ltd, England.

2. Essential References.

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Prof. Ali Alkaf	Dr. Abdulelah Thabet	Dr. -----	Dr. Abdulelah Thabet	Dr. Ali Alyahawi

- Jerry March (1992). Advanced Organic Chemistry, Reactions, Mechanisms, and structure, 4th ed, John Wiley and Sons, Inc., New York.

3. Electronic Materials and Web Sites etc.

Nil

XI. Course Policies: (Based on the Uniform Students' Bylaw (2007))

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Prof. Ali Alkaf	Dr. Abdulelah Thabet	Dr. -----	Dr. Abdulelah Thabet	Dr. Ali Alyahawi