Faculty: Pharmacy	
Department: pharmaceutical Science	**Program: M.Sc**
Academic year: 2023/2024	**Semester: 2nd**

Course Plan

First: Course Information

Course Title:	**Advanced Pharmaceutical Organic chemistry**			***Course No.*** **1101718**	
Credit Hours:	***3***	***Theoretical:***	***3***	***Practical:***	***0***
Prerequisite:		***Section No.: 1***		***Lecture Time: Monday-16:30-19:30***	
Level in JNQF	***9***		***Virtual hours in the JNQF***		***120h***
Type Of Course:	☐ ***Obligatory University Requirement*** ☐ ***Elective University Requirement*** × ***Obligatory Faculty Requirement*** ☐ ***Elective Faculty Requirement*** ☐ ***Obligatory Specialization Requirement*** ☐ ***Elective Specialization requirement*** ☐ ***Ancillary course***				
Type of Learning:	☐ ***Face-to-Face Learning*** ☐ ***Blended Learning (2 Face-to-Face + 1 Asynchronous)*** × ***Online Learning (3 Synchronous)***				

Second: Instructor's Information

Course Coordinator: Ahmad H. Abdullah		
Name: Ahmad H. Abdullah	***Academic Rank:*** ***Assistant professor***	
Office Number: 207D	***Ext. Number:***	***E-mail: aabdullah@zu.edu.jo***
Course Instructor:		
Name: Ahmad H. Abdullah	***Academic Rank:*** ***Assistant professor***	
Office Number: 207D	***Ext. Number:***	***E-mail: aabdullah@zu.edu.jo***
Office Hours:	***Sunday Tuesday Thursday (9-10)*** ***Monday Wednesday (2-3)***	

Third: Course Description

One approach to organic synthesis is retrosynthetic analysis. With this approach a medicinal chemist will start with the structure of their target molecule and progressively cut bonds to create simpler molecules. Reversing this process gives a synthetic route to the target molecule from simpler starting materials. This Introduces this important technique, to help students to design their own organic syntheses. It will give the ability for students to synthesis of given types of molecules alternate with strategy chapters in which the methods just learnt are placed in a wider context. This course cover many ways of making each type of molecule starting with simple aromatic and aliphatic compounds with one functional group and progressing to molecules with many functional groups. Also this course cover questions of selectivity, protection, stereochemistry, and develop more advanced thinking via reagents specifically designed for difficult problems. Examples are drawn from pharmaceuticals, natural products and intermediates used in more advanced synthetic work. Reasons for wishing to synthesis each compound are given. This course contain extensive new material based on courses that the authors give to medicinal chemists in the pharmaceutical industry. And finally this course provides a full course in retrosynthetic analysis for medicinal chemistry students and a refresher for medicinal chemists working in industry and academia.

Fourth: Course objectives

1- Gain a comprehensive understanding of retrosynthetic analysis as a fundamental approach in organic synthesis.
2- Enhance problem-solving skills by practicing the breakdown of complex target molecules into simpler precursor structures.
3- Learn to design efficient and practical synthetic routes to target molecules using retrosynthetic strategies.
4- Master the transformations and reactions of different functional groups to create various types of molecules.
5- Progress from synthesizing simple molecules with one functional group to designing synthetic pathways for complex molecules with multiple functional groups.
6- Apply a variety of synthetic methods and strategies to solve real-world problems in medicinal chemistry.
7- Foster collaboration and communication skills by working on team projects and presenting synthetic strategies.

Fifth: Learning Outcomes

Level descriptor according to (JNQF)	***CILOs Code***	***CILOs*** If any CILO will not be assessed in the course, mark NA.	***Associated PILOs Code*** *Choose one PILO for each CILO**	***Assessment method*** *Choose at least two methods*	***Scores out of 100*** State the total score identified for each CILO**	***Minimum acceptable Score/percentage (%)*** *The percentage should not be less than 70% ****
Knowledge	**K1**	Predict the products of the chemical organic reactions	P. K1	Mid, Final exam	20	14 (70%)
Skills	**S1**	Breakdown the bonds of complex compounds correctly to their starting material	P. S1	Mid, Final exam	50	35 (70%)
Competencies	**C1**	Solve high-level question that are related to complex system	P. C1	Assignments	10	7 (70%)
	C2	Explain the details of the reaction, including its mechanism, outcomes by presentation	P. C3	seminar	10	7 (70%)
	C3	Synthesize novel compounds based on	P. C1	project	10	7 (70%)

		the survey on the research project				

*For each CILO, the PILO could be the same or different.

Sixth: Learning Source

Main Reference:	Organic synthesis , the disconnection approach		
Author: Stuart Warren and Paul Wyatt	***Issue No.:*** Wiley – 2nd Edition	***Print:***	***Publication Year:2008***
Additional Sources &Websites:	1- Workbook for organic synthesis, the disconnection approach, second ethition, Stuart Warren and Paul Wyatt (2008) 2- Essetials of organic chemistry for students of pharmacy, medicinal chemistry, 1st edition Paul M Dewick (2006) 3- Organic chemistry, 2nd etition, Jonathan Clayden Nick Greeves and Stuart Warren (2012). ***4-*** Organic Chemistry, J.. Mc-Murry, 2008, 8th edition.		
Teaching Type:	☐ ***Classroom*** ☐ ***Laboratory*** ☐ ***Workshop*** × ***MS Team*** ☐ ***Moodle***		

Seventh: Course Structure

Lecture Date	Covered CILOs	Topics	Teaching Procedures *	Teaching **Methods	**References*** ** Organic synthesis , the disconnection approach (ISBN **0470712368**)
4/3	K1	**Introduction to the course – Course outline** **Some Basic of organic Chemistry**	Online learning	Lecturing, discussion	
11/3	K1, S1	**The disconnection approach** **The synthesis of multistriatin**	Online learning	Lecturing, discussion	**1-5**
18/3	K1, S1	**Basic principles: synthons and reagents .** **Synthesis of aromatic compounds** **(electrophilic aromatic substitutions and electrophilic alkene)** **Synthesis and retro-synthesis of anti-inflammatory lobenzarit**	Online learning	Lecturing, discussion	**8-15**

25/3	K1, S1	**Strategy I: the order of events (the orders of reagents and steps for compound synthesis)** **Synthesis of bumetamide**	Online learning	Lecturing, discussion	**17-22**
1/4	K1, S1	**One-group C-X disconnections** **Nuclophilic substitution at carbonyl group and nuclophilic substituition at saturated carbon** **Synthesis and retrosynthesis of S-fluoxetine Prozac**	Online learning	Lecturing, discussion	23-28
8/4	K1, S1	**Chemoselectivity** **(Selective reaction and concept of protection group)** **Synthesis and retrosynthesis of antihistamine ebastine**	Online learning	Lecturing, discussion	**29-34**
15/4	K1, S1	**Two group C-X disconnections** **Congugate addition** **Formation and reaction of enols and enolate**	Online learning	Lecturing, discussion	**35-44**
22/4	K1, S1	**Reversal of polarity, cyclisation** **Synthesis of epoxides and alpha-halo carbonyl compounds** **Synthesis of anti-biotic drugs**	Online learning	Lecturing, discussion	**45-52**
29/4	K1, S1	**Amine synthesis** **Nuclophilic substituition at C=O with loss of carbonyl oxygen** **Synthesis and**	Online learning	Lecturing, discussion	**53-60**

		retro-synthesis of cinalcet drug **Synthesis and retro-synthesis of anti-HIV drug maraviroc**			
6/5	K1, S1	**Protecting group Chemoselectivity** **Synthesis and retro-synthesis of anti Aids drug** **Synthesis and retro-synthesis of statins (chloestrol lowering drug)**	Online learning	Lecturing, discussion	**61-68**
13/5	K1, S1	**One group C-C disconnection I: alcohols Using organometallic reagents to make C-C bonds.** **Synthesis and retro-synthesis of clostantel drug** **موعد التسليم**	Online learning	Lecturing, discussion	**69-76**
20/5-3/6	**C2**	**Seminars**			
9/6		**Start of final**			

Teaching procedures: (Face-to-face, synchronous, asynchronous). * * Teaching methods: Lecture, video…..). *** Reference: Pages of the book, recorded lecture, video….)

Eighth: Assessment methods

Methods	Online Learning	Blended Learning	Face-To-Face Learning	K1	S1	C1	C2	C3
Mid-term Exam				10	20			
Final Exam				10	30			
project								10
Assignments						10		
Group presentation							10	
Total out of 100				20	50	10	10	10

***Refer to document (CC-2023-03)**

Ninth: Course Policies

- All course policies are applied on all teaching patterns (online, blended, and face-to-face Learning) as follows:
  a. Punctuality.
  b. Participation and interaction.
  c. Attendance and exams.
- Academic integrity: (cheating and plagiarism are prohibited).
- Meeting the deadline for the lecture.
- Commitment to interaction and participation.
- Interactive lectures will be given through a platform (MS Teams).
- Duties and tests will be given through a platform (Moodle).
- Commitment to the right appearance with the proper background in front of the camera.
- University regulations for attendance and absence from lectures and examinations are in force.
- Academic Integrity: According to university regulations and instructions, fraud or moral impersonation is unacceptable and punishable.

Approval	Name	Date	Signature
Head of Department			
Faculty Dean			