

# The University of Jordan

**Faculty: Pharmacy**                      **Department: Pharmaceutical Sciences**  
**Program: BSc and PharmD.**      **Academic Year/ Semester: 2013/2014, 1<sup>st</sup>**

## *Pharmaceutical Organic Chemistry I-practical (I)* **(1211212)**

<b>Credit hours</b>	1/practical	<b>Level</b>	Second year	<b>Pre-requisite</b>	1201215
<b>Coordinator/ Lecturer</b>	Prof. Dr. Yusuf Al-Hiari (Coordinator)	<b>Office number</b>	313	<b>Office phone</b>	23292
<b>Course website</b>		<b>E-mail</b>	hiary@ju.edu.jo	<b>Place</b>	Pharmacy labs

<b>Office hours</b>					
<b>Day/Time</b>	<b>Sunday</b>	<b>Monday</b>	<b>Tuesday</b>	<b>Wednesday</b>	<b>Thursday</b>
Prof. Dr. Yusuf al-Hiari	1-2	1-2	1-2	1-2	1-2

### Course Description

This course will cover practical applications of various methods and techniques used for the identification of functional groups of organic compounds of pharmaceutical interest, giving more attention toward chemical identification. In addition, synthesis of some organic and pharmaceutical compounds such as aspirin will be commenced. Practical sessions are meant to increase understanding of the physical-chemical properties of functional groups carried within pharmaceutical drugs. The course does introduce the students to safety rules and methodologies in handling chemicals and conducting experiments.

## **Learning Objectives**

- 1- Providing the students with practical applications of various methods and techniques used for the identifications of functional groups of organic compounds imported on drugs
- 2- Understanding and investigating the physical and chemical behavior of each functional group, through practical experimental approaches related to each functional group.
- 3- Introducing the students to organic chemistry laboratory (instruments, glassware, chemicals,..) and techniques ( purification and separation, chemical and physical identification, extraction, distillation, refluxing, crystallization,...).
- 4- Student should gain some practical skills needed in synthetic organic laboratory, through synthesizing some organic and pharmaceutical compounds.
- 5- Students should gain good knowledge of safety precautions and laboratory rules implemented in Organic Chemistry Laboratory. They should also know how to handle chemicals and glasswares safely.

## **Intended Learning Outcomes (ILOs):**

Successful completion of the course should lead to the following outcomes:

- A. Knowledge and Understanding:** Student is expected to understand
- A1. Physical behavior and chemical identification of functional groups in organic compounds.
  - A2. The importance of functional groups in pharmaceutical behavior of Drugs.
  - A3. Practical experience in drugs synthesis and identification based on these functional groups.
- B. Intellectual Analytical and Cognitive Skills: Student is expected to**
- B1. Application of practical experience in identification of any unknown functional group or drugs incorporating these groups; such as Alcohols, Phenols, Ethers, Aldehydes, Ketons, Carboxylic acids and their derivatives, Nitro and Amino compounds.
  - B2. Ability to synthesis some simple organic compounds and drugs such as Aspirin in organic laboratory implementing all techniques gained in this course.
  - B3. Ability to understand and explain theoretical mechanism or behavior of certain drugs based on simple laboratory tests or reactions.

**C. Subject-Specific Skills: Student is expected to**

C1. Chemical and physical identification of basic organic functional groups through basic practical test performed in any organic laboratory.

C2. Acquaint practical skills regarding synthesis techniques, and preparation tools, in addition to methods of identification, classification, chemical and physical evaluation.

C3. Practicing special techniques related to organic synthesis such as crystallization, melting point determination, distillation and refluxing.

C4. Acquaint practical skills regarding to safe chemical handling and disposal.

C5. Utilizing the concept of functional groups alteration, modification, derivitization in pharmaceutical drugs as tools for identification, characterization, purification, or even to improving the biological activity of a drug.

**D. Transferable Key Skills: Students is expected to**

D1. Work in a team to organize and plan a synthetic experiment and fulfill course library requirements (writing scientific report). This must reflect positively on his future training of how to choose the right tools and approaches to conduct his experiment.

D2. Master the rules of laboratory safety protocols and procedures needed for next laboratories.

D3. Share, discuss and express ideas while working in group discussion sessions (Group discussion sessions to answer some questions)

D4. Gaining some electronic and internet experience while answering some problems through visiting specific web sites related to organic chemistry and answering preparing assignments using internet, and PC.

D6. Developing problem solving approach.

**ILOs: Learning and Evaluation Methods**

ILO/s	Learning Methods	Evaluation Methods
A. Knowledge and Understanding	Lectures and Discussions within practical sessions	Theoretical and practical exam and Quiz
B. Intellectual Analytical and Cognitive Skills	practical sessions oral discussion	Practical exam, Quiz

C. Subject-Specific Skills	Lectures, Discussions, and Assignments, homework , library work	Reports, practical exam, Quiz, and Assignments, library work, Computer aided learning sessions
D. Transferable Key Skills	Assignments and group discussion	Quiz and Assignments and Reports (using internet and PC software)

## Course Contents

Content	Reference	Week	ILO/s
<b>1-Introduction: Laboratory rules and safety precautions</b>	1,2,3	2 (1Cr.Hr = 3 practical hours)	A-D
<b>2- Functional group identification</b>			
Part 1: Mono-hydric alcohols	1,2,3	3 (1Cr.Hr )	A-D
Part 2: Poly-valent alcohols and phenols	1,2	4 (1Cr.Hr )	A-D
Al-Adha Holiday		5	
Part 3: Aldehydes and Part 4: Ketones	1,3	5 (1Cr.Hr )	A-D
<b>3- Solid derivatives of aldehydes and ketones</b>			
Part1: Benzaldehyde phenylhydrazone	1,2,3	6 (1Cr.Hr )	A-D
Part 2: Cyclohexanone semicarbazone and	1,2,3	7 (1Cr.Hr )	A-D
<b>Assignment 1</b>		<b>7(first week of Nov.)</b>	<b>A,B,C,D</b>
<b>Midterm Exam</b>		<b>8</b>	
Part 3: Acetoximes and other solid derivatives		<b>practical lab and theoretical quiz</b>	
<b>4- Carboxylic acids</b>			
Part 1: Identification	1,2,3	9 (1Cr.Hr )	A-D
Part 2: Individual reactions for each acid	1,2,3	10 (1Cr.Hr )	A-D
<b>5- Synthesis:</b>			

Part 1: Synthesis of Phenyl benzoate, benzamide	1,2,3	11 (1Cr.Hr )	A-D
Part 2: Synthesis of Aspirin (	1,2,3	12 (1Cr.Hr )	A-D
<b>Assignment 2</b>		<b>13 (mid of Dec.)</b>	<b>A,B,C,D</b>
Part 3: Synthesis of Paracetamol (Panadol®)	1,2,3	13 (1Cr.Hr )	A-D
Part 4: Synthesis of isoamyl ester (Banana oil, flavoring agent)	1,2,3	14 (1Cr.Hr )	A-D
<b>Final Exam</b>		15-16	

### Learning Methodology

- 1- Practical laboratory sessions: including short lectures
- 2- Demonstration
- 3- Group discussion/ oral discussion sessions
- 4- Assignments, homework, library work
- 5- Problem solving discussion
- 6- Computer aided learning sessions/ extra learning for who is interested (deals with topics)

### Projects and Assignments

- 1- Students should submit submit an assignment explaining all techniques used in organic chemistry laboratory and the tools, glassware and equipment involved. This must cover purification and separation, chemical and physical identification, extraction, distillation, refluxing and crystallization involving instruments, glassware, chemicals, and techniques. Week 7
- 2- Each student must search the internet/library for a drug that contains the functional groups explaining the physical/chemical identification of such functional group within the chosen drug. He must explain the physical/chemical identification protocols followed and method of synthesis of this drug (detailed planned scheme for multi-step synthesis of the drug) and the role of these groups in the structure activity relationship. Week 13

## Evaluation

Evaluation	Point %	Date
<b>Midterm Exam</b> - Practical: -Theoretical:	<b>30</b> 20 10	8 <sup>th</sup> week
<b>Quizzes and Assignments and reports:</b>	<b>30</b>	
Assignments 1	5	7 <sup>th</sup> Week
Assignments 2	5	13 <sup>th</sup> Week
Quiz (within session)	5	13 <sup>th</sup> Week
Reports	10	(average of best 10)
Practical skills-assessment: Techniques, procedures and safe-handling of chemicals	5	With each session
<b>Final Exam</b> -Practical: -Theoretical:	<b>40</b> 30 10	<b>To be assigned</b>

### Textbook:

- 1- The systemic identification of organic compounds by Shriner
- 2- Introduction to Modern Experimental organic Chemistry, By Robert Gilbert
- 3- Unitized Experiments in Organic Chemistry, 4<sup>th</sup> ed., by Brewster, VanderWerf and McEwen