



**Zagazig University**  
**Faculty of Pharmacy**  
**Pharmaceutical Organic Chemistry**  
**Department**

**Program and Course Specifications**  
**Master and Ph.D.**  
**Degrees**

**2012/2013**

# Master Degree

# Program Specification

## Program Specification

### A- Basic Information

- 1- Program title:** M.Pharm. Sci Degree in **Pharmaceutical Organic Chemistry**
- 2- Program type:** Monodisciplinary.
- 3- Faculty/ University:** Faculty of Pharmacy, Zagazig University
- 4- Department:** Pharmaceutical Organic Chemistry
- 5- Coordinator:** Prof. Dr. Eatedal H. Abd El-aal
- 6- Date of program specification approval:** 2012

### B- Professional Information

#### 1- Program aims:

The Pharmaceutical Organic Chemistry master's program aims to provide the postgraduate master students with a special and advanced education in the field of Pharmaceutical organic chemistry and enable them to gain the skills and attributes required for the responsible practice of Organic chemistry experiments.

#### 2-Intended Learning Outcomes (ILOs):

The Program provides excellent opportunities for students to demonstrate knowledge and understanding qualities and develop skills appropriate for Pharmaceutical Organic Chemistry Master of sciences degree.

#### 2-1- Knowledge and Understanding :

**On successful completion of the Master degree Program, students will be able to:**

A.1-Demonstrate the principles of advanced organic chemistry and its related subjects including advanced heterocyclic chemistry,

fundamentals of combinatorial chemistry and organic chemistry of drug synthesis.

A.2- Contribute to the development of health care through the synthesis of novel advantageous drug candidates.

A.3- Understand recent applications of organic chemistry in drug synthesis.

A.4- Aware the legal authorities for professional practices in advanced organic chemistry.

A.5- Determine the basics to good laboratory practice and quality assurance in advanced organic chemistry.

A.6- Shows clearly full consciousness of ethics in all aspects of scientific research.

### **2-2 - Intellectual Skills:**

**On successful completion of the Master degree Program, students will be able to:**

B.1- Interpret spectroscopic data in a specific and suitable form to identify new organic compounds.

B.2- Employ the available data to predict the synthetic pathways and mechanisms.

B.3- Evaluate the expected problems and side reactions that might emerge during the synthesis and successfully find out the necessary precautions for the recovery of a pure target.

B.4- Design full schemes on the obtained results with conclusive significances.

B.5- Manage risks during dealing with chemical reagents.

B.6- Improve a laboratory schemes for an advanced organic chemistry issue.

B.7- Take professional decisions in proving target compounds.

### **2-3 - Professional and Practical Skills:**

**It is intended that, on successful completion of the Master degree Program, students will be able to:**

C.1- Apply professional skills in synthesis and analysis of different pharmaceutical organic compounds.

C.2- Write down and discuss results in the form of thesis and scientific papers.

C.3- Choose and implement perfectly the proper techniques during practical work.

### **2-4 - General and Transferable Skills:**

**On successful completion of the Master degree Program, students will be able to:**

D.1- Contact effectively with professionals.

D.2- Deals with computer and internet skills for collecting scientific materials.

D.3- Pursuit self estimation in advanced organic chemistry for personal learning needs.

D.4- Restore information from different sources in the field of advanced organic chemistry.

D.5- Apply standards for judging others performance in the field of advanced organic chemistry.

D.6- Activate working as a member of a team.

D.7- Run time successfully to get goals.

D.8- Get independent learning for research studies.

### 3- Academic Standards:

- NARS (National Academic Reference Standards)

**Matrix:** Comparison between Master degree program ILOs and the National Academic Reference Standards

NARS vs. Program ILOs for Masters in Pharmaceutical Organic Chemistry		
	NARS	Program ILOs
<b>Knowledge and Understanding</b>	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.1-Demonstrate the principles of advanced organic chemistry and its related subjects including advanced heterocyclic chemistry, fundamentals of combinatorial chemistry and organic chemistry of drug synthesis.
	2.1.2- Mutual influence between professional practice and its impact on the environment.	A.2- Contribute to the development of health care through the synthesis of novel advantageous drug candidates.
	2.1.3- Scientific developments in the area of specialization.	A.3- Understand recent applications of organic chemistry in drug synthesis.
	2.1.4- Moral and legal principles for professional practice in the area of specialization.	A.4- Aware the legal authorities for professional practices in advanced organic chemistry.

	2.1.5- Principles and the basics of quality in professional practice in the area of specialization.	A.5- Determine the basics to good laboratory practice and quality assurance in advanced organic chemistry.
	2.1.6- The fundamentals and ethics of scientific research.	A.6- Shows clearly full consciousness of ethics in all aspects of scientific research.
<b>Intellectual Skills</b>	2.2.1- Analyze and evaluate information in the field of specialization and analogies to solve problems	B.1- Interpret spectroscopic data in a specific and suitable form to identify new organic compounds.
	2.2.2- Solve specified problems in the lack or missing of some information.	B.2- Employ the available data to predict the synthetic pathways and mechanisms.
	2.2.3- Correlate and integrate different pharmaceutical knowledge to solve professional problems.	B.3- Evaluate the expected problems and side reactions that might emerge during the synthesis and successfully find out the necessary precautions for the recovery of a pure target.
	2.2.4- Conduct research and write scientific report on research specified topics.	B.4- Design full schemes on the obtained results with conclusive significances.



	2.2.5- Evaluate and manage risks and potential hazards in professional practices in the area of specialization	B.5- Manage risks during dealing with chemical reagents.
	2.2.6- Plan to improve performance in the field of specialization.	B.6- Improve a laboratory schemes for an advanced organic chemistry issue.
	2.2.7- Professional decision-making in the contexts of diverse disciplines.	B.7- Take professional decisions in proving target compounds.
<b>Professional and Practical Skills</b>	2.3.1- Master basic and modern professional skills in the area of specialization.	C.1- Apply professional skills in synthesis and analysis of different pharmaceutical organic compounds.
	2.3.2- Write and evaluate professional reports.	C.2- Write down and discuss results in the form of thesis and scientific papers.
	2.3.3- Assess methods and tools existing in the area of specialization.	C.3- Choose and implement perfectly the proper techniques during practical work.
<b>General and Transferable Skills</b>	2.4.1- Communicate effectively.	D.1- Contact effectively with professionals.
	2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.

2.4.3- Self-assessment and define his personal learning needs.	D.3- Pursuit self estimation in advanced organic chemistry for personal learning needs.
2.4.4- Use variable sources to get information and knowledge.	D.4- Restore information from different sources in the field of advanced organic chemistry.
2.4.5- Set criteria and parameters to evaluate the performance of others	D.5- Apply standards for judging others performance in the field of advanced organic chemistry.
2.4.6- Work in a team and lead teams carrying out various professional tasks.	D.6- Activate working as a member of a team.
2.4.7- Manage time effectively.	D.7- Run time successfully to get goals.
2.4.8- Continuous and self learning.	D.8- Get independent learning for research studies.

#### 4-Curriculum Structure and Contents:

**a- Program duration:** 3- 5 years

**b- Program structure:**

- The Masters program can be completed in 3-5 years.
- The Faculty of pharmacy implements the credit hour system.
- The program is structured as:

**1- Courses: General (1 year) and Special**

**No. of credit hours for program courses:**

Compulsory: 12

Elective: (2x4) 8

Special: (3x4) 12

**2- Thesis:** 30 hours

The candidate must complete a research project on an approved topic in the Pharmaceutical Sciences. To fulfill this requirement the student must present (written and orally) a research proposal and write a thesis.

**3- General University Requirements:** 10 credit hours including:

a- TOEFL (400 units)

b- Computer course

**c-Program Curriculum:**

Course Code	Course Title	Credit hours	Program ILOs Covered
	General Courses:		
M109	Drug design	4	A1, A2, A3, B3, D2, D4, D8
M101	Advanced Instrumental Analysis & chromatography I	2	A1, A2, B3, D1
M106	Physical chemistry	2	A1, A2, A3, B1, B6, D2
ME3	Elective A Good practice for analysis of drugs and	4	A1, A2, B2, B3, D2, D5, D6

	quality control		
ME2	Elective B Drug Stability	4	A1, A2, A3, B3 D2, D4, D6, D8
	Special Courses:		
Osp1	Advanced Organic Chemistry: Structure and Mechanism	4	A1, B2, B3, B5, D1, D2, D4, D7 and D8
Osp2	Advanced Organic Chemistry: Reactions and Synthesis	4	A1, B2, B3, B6, B7, D1, D2, D4, D7 and D8
Osp3	Advanced Heterocyclic Organic Chemistry	4	A1, A3, B2, B3, B6, D1, D2, D4, D7 and D8
	Thesis	30	A1, A2, A3, A4, A5, A6, B1, B2, B3, B4, B5, B6, B7, C1, C2, C3, D1, D2, D3, D4, D5, D6, D7 and D8

### 5-Program admission requirements:

- Candidate should have obtained the certificate of Bachelor degree in pharmaceutical sciences with general grade good and grade good in the specialty from one of the Egyptian universities or an equivalent certificate from a foreign institute recognized by the university.

- Admission is in October each year.

## 6- Admission Policy:

The faculty complies with the admission regulations and requirements of the Egyptian Supreme Council of Universities (ESCU).

## 7-Student assessment methods:

Method	ILOS
Written exam	Knowledge and Understanding and Intellectual Skills
Oral exam	Knowledge and Understanding ,Intellectual Skills and General and Transferable Skills
Activity	Intellectual Skills and General and Transferable Skills
Seminars	Knowledge and Understanding ,Intellectual Skills & General and Transferable Skills
Follow up	Professional and practical Skills & General and Transferable Skills
Thesis and oral presentation	Knowledge and Understanding, Intellectual Skills, Professional and practical Skills & General and Transferable Skills

Grade Scale	Grade point average value (GPA)	Numerical scale
A+	5	≥ 95%
A	4.5	90- < 95%
B+	4	85- < 90%
B	3.5	80- < 85%

C+	3	75- < 80%
C	2.5	70- < 75%
D+	2	65- < 70%
D	1.5	60- < 65%

### 8-Failure in Courses:

Students who fail to get 60% (1 point)

### 9-Methods of program evaluation

<b>Evaluator</b>	<b>Method</b>	<b>Sample</b>
<b>Internal evaluator:</b> Professor Dr. Eatedal Hassan	Program evaluation Courses evaluation	Program report Courses report
<b>External evaluator:</b> Professor Dr. Fatma Elnabaweya Goda	Program evaluation Courses evaluation	Program report Courses report
<b>Others methods</b>	Matrix with NARS Questionnaires	The Matrix Results of the questionnaires

**Program coordinator**  
**Prof. Dr. Azza Kadary**

**Head of Department**  
**Prof. Dr. Eatedal H. Abd El-aal**

# Courses offered by other departments

## Course specification of Drug Design

### A- Course specifications:

- Program on which the course is given: Master of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmaceutical organic chemistry
- Department offering the course: Medicinal chemistry Dept.
- Date of specification approval: 2012/2013

### 1- Basic information:

Title: **Drug Design**  
Lectures: 4 hrs/week  
Total: 4 hrs/week

Code: M109  
Credit hours: 4 hrs/week

### 2- Overall aim of the course:

On completion of the course, the students will be able to define the drug design, diagnose possible techniques for drug design and discuss different methods of drug development.



### 3. Intended learning outcome s (ILOs) of Drug Design

<b>Knowledge and Understanding</b>	
<b>a1</b>	Outline basic information related to drug design
<b>a2</b>	Identify applications of drug design and drug development
<b>a3</b>	Illustrate clearly the up-to date information & methods in drug design
<b>Intellectual skills</b>	
<b>b1</b>	Solve or propose solutions to specified problems in drug design
<b>General and Transferable skills</b>	
<b>d1</b>	Write reports and present it.

### 4. Course Content of Drug Design

<b>Week number</b>	<b>Lecture contents (4hrs/week)</b>
1	Definition of drug design.
2	Drug design applications.
3	Docking.
4	Docking.
5	Combinatorial chemistry
6	Combinatorial chemistry
7	Drug development. <b>Activity(Reports)</b>
8	SAR & QSAR in drug design
9	Drug latentiation.
10	Drug latentiation
11	Principles in drug Modeling
12	Computer-aided drug design <b>Activity( Reports)</b>
13	Drug metabolism (Phase I)
14	Drug metabolism (Phase II)
15	Revision & Open Discussion

### 5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussions

### **6- Student Assessment methods:**

- Written exams to assess: a1,a2,a3&b1
- Oral exams to asses: a1,a2,a3&b1
- Activities to asses: d1

### **Assessment schedule:**

<b>Assessment (1):</b> Activity	Week 7-12
<b>Assessment (2):</b> Written exam	Week 16
<b>Assessment (3):</b> oral exam	Week 16

### **Weighting of Assessment:**

<b>Assessment method</b>	<b>Marks</b>	<b>Percentage</b>
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
<b>TOTAL</b>	<b>100</b>	<b>100%</b>

### **7- References and books:**

#### **A-Scientific papers**

#### **B- Essential books:**

i- Burger's medicinal chemistry and drug discovery

Edited by Manfred E.wolff(2006)

ii- Computer-aided molecular design

Application of Agrochemicals, Materials & pharmaceuticals

Edited by Charles H.Reynolds,M.Katharine Holloway and Harold

K.COX(2003)

**C- Suggested books:**

i- The organic chemistry of drug design and drug action ,second edition, Edited by Richard B.Silverman.(2005)

ii- Designing Bioactive molecules

Three dimensional Techniques and applications , Edited by Yvonne C.Martin and Peter Willett.(2009)

**D- Websites:**

<http://www.ncbi.nlm.nih.gov/sites/entrez>

<http://journals.tubitak.gov.tr/chem/index.php>

<http://www.pharmacopoeia.co.uk/>

[www.Pubmed.Com](http://www.Pubmed.Com)

[www.sciencedirect.com](http://www.sciencedirect.com)

**Facilities required for teaching and learning:**

**For lectures:** Black (white) boards, computers and data show.

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- **Course Coordinators: Prof.Dr/Mohammed Al-hussany**
- **Head of Department: Prof.Dr/ Mansour Abukull**
- **Date: 2012/9/3 تم اعتماد التوصيف بالقسم بتاريخ**

## Course specification of Advanced Instrumental Analysis & chromatography I

### A- Course specifications:

- Program on which the course is given: Master of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmaceutical organic chemistry
- Department offering the course: Medicinal chemistry Dept.
- Date of specification approval: 2012/2013

### 1- Basic information:

Title: **Advanced Instrumental Analysis & chromatography I**

Code: M101

Lectures: 4 hrs/week

Credit hours: 4 hrs/week

Total: 4 hrs/week

### 2- Overall aim of the course:

On completion of the course, the students will be able to demonstrate fundamental knowledge and basic theories in instrumental analysis, state the concepts of diagnosing cardiac diseases, G.I.T diseases and infections through IR, HNMR and UV spectrophotometry and state the basic principles of (HPLC), HPLC/Mass, Gas Chromatography (GC) and GC/Mass and their medicinal applications.

### 3. Intended learning outcomes (ILOs) of Advanced Instrumental Analysis & chromatography I

<b>Knowledge and Understanding</b>	
<b>a1</b>	Illustrate properly theories of different instruments used in analysis
<b>a2</b>	State medicinal and pharmaceutical applications of spectroscopy , HPLC and GC
<b>Intellectual skills</b>	
<b>b1</b>	Analyze & interpret qualitative & quantitative data obtained from instrumental analysis
<b>General and Transferable skills</b>	
<b>d1</b>	Write reports and present it.

### 4. Course Content of Advanced Instrumental Analysis & chromatography I:

<b>Week number</b>	<b>Lecture contents (4hrs/week)</b>
1	Ultra-violet spectroscopy
2	Vibrational spectroscopy (IR spectroscopy )
3	Nuclear magnetic resonance (NMR)
4	Mass spectrometry(MS)
5	Medicinal application of spectroscopy in diagnosis of diseases
6	Surface analysis
7	Liquid chromatography <b>Activity (Reports)</b>
8	HPLC & its theory
9	HPLC & its medicinal and pharmaceutical application
10	Gas chromatography its theory
11	GC & its medicinal and pharmaceutical application
12	Supercritical fluid chromatography (SFC)
13	Capillary electrophoresis(CE)
14	Analytical application of polymers <b>Activity (Reports)</b>
15	Revision & open discussion

## 5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion

## 6- Student Assessment methods:

Written exams to assess: a1,a2&b1

Oral exams to assess: a1, a2&b1

Activities to asses: b1&d1

### **Assessment schedule:**

<b>Assessment (1):</b> Activity	Week 7-14
<b>Assessment (2):</b> Written exam	Week 16
<b>Assessment (3):</b> oral exam	Week 16

### **Weighting of Assessment:**

<b>Assessment method</b>	<b>Marks</b>	<b>Percentage</b>
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
<b>TOTAL</b>	<b>100</b>	<b>100%</b>

## 7- References and books:

### **A-Scientific papers**

### **B- Essential books:**

-Chemical stability of pharmaceuticals, Kenneth A. Connors, Kenneth Antonio Connors, Gordon L. Amidon, Valentino J. Stella

-Pharmaceutical process validation Robert A. Nash, Alfred H. Wachter (2006)

### **C- Suggested books:**

-Photostability of drugs and drug formulations, Hanne Hjorth Tønnesen ( 2004)

-U.S.P. & B.P (2010)

**D- Websites:**

<http://www.ncbi.nlm.nih.gov/sites/entrez>

<http://journals.tubitak.gov.tr/chem/index.php>

<http://www.pharmacopoeia.co.uk/>

[www.Pubmed.Com](http://www.Pubmed.Com)

[www.sciencedirect.com](http://www.sciencedirect.com)

**Facilities required for teaching and learning:**

1. **For lectures:** Black (white) boards, computer and data show.

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- **Course Coordinators: Prof. Dr. Al Sayed Lashen**
  - **Head of Department: Prof.Dr/ Mansour Abukull**
  - **Date: 2012/9/3 تم اعتماد التوصيف بالقسم بتاريخ**

## Course specification of Physical Chemistry

### A- Course specifications:

- Program on which the course is given: Master's of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmaceutical organic chemistry
- Department offering the course: Analytical Chemistry.
- Date of specification approval: 2012/2013

### 1- Basic information:

Title: **Physical Chemistry**  
Lectures: 4 hrs/week  
Total: 4 hrs/week

Code: M106  
Credit hours: 4 hrs/week

### 2- Overall aim of the course:

On completion of the course, the students will be able to outline the principles of physical, general chemistry, thermochemistry and thermodynamics and describe states of matter, units of measurements and calculations with chemical formulas and equations.



### 3. Intended learning outcome s (ILOs) of Physical Chemistry:

<b>A- Knowledge and Understanding</b>	
<b>a1</b>	Outline the principles of physical, general chemistry, thermochemistry and thermodynamics.
<b>a2</b>	Demonstrate the behavior and laws governing gas, solutions and colloids.
<b>B- Intellectual skills</b>	
<b>b<sub>1</sub></b>	Describe units of measurements and calculations with chemical formulas and equations.
<b>b<sub>2</sub></b>	Integrate the knowledge and information obtained from physical and general chemistry principles in determining molecular formulas and stoichiometry of the reaction.
<b>D- General and Transferable skills</b>	
<b>d<sub>1</sub></b>	Acquire Computer skills like preparing presentations and collecting information through different data-bases.
<b>d<sub>2</sub></b>	Work effectively as a member of team
<b>d<sub>3</sub></b>	Improve scientific brain storming capabilities of team members

### 4. Course Contents of Physical Chemistry:

<b>Week number</b>	<b>Contents</b>
1	Introduction, classification, state and properties of matter
2	Units of measurements and dimensional analysis.
3	Calculations with chemical formulas and equations.
4	Gases Physical behavior of gases. Measurement of gas pressure

5	The gas laws: Boyles law. Charles law. Gay-lussac's law. Combined gas law.
6	The ideal gas equation. Dalton Law. Graham's law. Deviation from ideal behavior.
7	Thermochemistry: Introduction. Internal energy E. Heat content. Thermochemical equations.
8	Heat of Combustion Heat of formation Variation of heat of reaction with temperature.
9	Thermodynamics: The second law of thermodynamics Measurement of the heat of the reaction
10	Solutions: Principles and concentration and solubility.
11	Factors affecting solubility Solute-solvent interaction. Solubility and temperature. Effect of pressure on solubility.
12	Solutions of liquids in liquids Solutions of solid in liquids (Colligative properties of

	solutions.)
13	Colloids Types of colloids Preparation of sols.
14	Purification of sols. Electrical properties of sols.
15	Open discussion and revision

### 5- Teaching and Learning Methods:

- Lectures
- Self learning

### 6- Student Assessment methods:

Written exams to assess: a1, a2, b1 and b2

Oral exam to assess: a1, a2, b1 and b2

Activity to assess: d1, d2 and d3

### **Assessment schedule:**

<b>Assessment (1):</b> Activity	Week 8
<b>Assessment (2):</b> Written exam	Week 16
<b>Assessment (3):</b> oral exam	Week 16

### **Weighting of Assessment:**

<b>Assessment method</b>	<b>Marks</b>	<b>Percentage</b>
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
<b>TOTAL</b>	<b>100</b>	<b>100%</b>

## **7- References and books:**

### **A-Scientific papers**

### **B- Essential books:**

Physical Chemistry , Developing A Dynamic Curriculum , Richard N. Schwenz & Robert G. Moore , American Chemical Society (1993)

### **C- Suggested books:**

Principles of Physical Chemistry( Part 1-2) by Lion el M. Raff, Prentice Hall; 1st edition (2001) .

Physical chemistry of surfaces, Arthur Ademson, John Wiley & Sons.inc:1st edition (2000).

### **D- Websites:**

[www.sciencedirect.com](http://www.sciencedirect.com)

[www.rsc.org](http://www.rsc.org)

## **Facilities required for teaching and learning:**

**For lectures:** Black (white) boards, computer, data show.

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- **Course Coordinators:** Ass. Prof Dr/ Wafaa Hassan
- **Head of Department:** Prof Dr/ Mohamed Nageb El-Balkeny
- **Date:** 2012/8/28 تم اعتماد التوصيف بالقسم بتاريخ

## Course specification of Drug stability

### A- Course specifications:

- **Program on which the course is given:** Master of Pharmaceutical Sciences
- **Major or Minor element of program:** Major
- **Department offering the program:** Pharmaceutical organic chemistry
- **Department offering the course:** Pharmaceutics Dept.
- **Date of specification approval:** 2012/2013

### 1- Basic information:

Title: **Drug stability**  
Lectures: 4 hrs/week  
Total: 4 hrs/week

Code: ME2  
Credit hours: 4 hrs/week

### 2- Overall aim of the course:

On completion of the course, the students will be able to describe the degradation of drugs and the methods to determine the order of reaction, Illustrate the stability programs for pharmaceutical products and the latest regulations for stability testing and gain the ability to predict the degradation pathways of a drug design a stabilization protocol and predict a product shelf-life.

**3- Intended learning outcome s (ILOs) of Drug stability:**

<b>Knowledge and Understanding</b>	
<b>a1</b>	Illustrate the principles of order of reactions and methods of determination order of reactions
<b>a2</b>	Describe the principles of physical and chemical degradation of drugs in different dosage forms
<b>a3</b>	Mention stability testing of different dosage forms
<b>Intellectual skills</b>	
<b>b1</b>	Suggest suitable stabilization methods for drugs in the various dosage forms.
<b>b2</b>	Design in a self-directed and original research investigations on drug stability in dosage forms from degradation pathways
<b>General and Transferable skills</b>	
<b>d1</b>	Demonstrate critical thinking and decision making during pharmaceutical preparations

**4. Course Content of Drug stability:**

<b>Week number</b>	<b>Lecture content (4 hrs/week)</b>
1	<ul style="list-style-type: none"> <li>• Rate of chemical reactions</li> </ul>
2	<ul style="list-style-type: none"> <li>• Orders of reactions</li> <li>• Zero order</li> </ul>
3	<ul style="list-style-type: none"> <li>• First order</li> </ul>
4	<ul style="list-style-type: none"> <li>• Second order</li> </ul>
5	<ul style="list-style-type: none"> <li>• Apparent zero order reaction</li> <li>• Pseudo first order reaction</li> </ul>
6	<ul style="list-style-type: none"> <li>• Determination of order of reaction</li> <li>• Substitution method</li> </ul>
7	<ul style="list-style-type: none"> <li>• Graphical method</li> </ul> <p style="text-align: center;"><b>(Presentation)</b></p>
8	<ul style="list-style-type: none"> <li>• Half-life method</li> </ul>
9	<ul style="list-style-type: none"> <li>• Routes of degradation</li> <li>• Hydrolysis</li> <li>• Oxidation</li> </ul>
10	<ul style="list-style-type: none"> <li>• Photochemical degradation</li> <li>• Incompatibility</li> </ul>
11	<ul style="list-style-type: none"> <li>• Physical degradation routes</li> </ul>

	<ul style="list-style-type: none"> <li>• Vaporization</li> <li>• Aging</li> <li>• adsorption</li> </ul>
12	<ul style="list-style-type: none"> <li>• Complex reactions</li> </ul>
13	<ul style="list-style-type: none"> <li>• Stability testing</li> </ul>
14	<ul style="list-style-type: none"> <li>• Revision</li> </ul>
15	<ul style="list-style-type: none"> <li>• Open discussion</li> </ul> <p style="text-align: center;"><b>(Final Presentation)</b></p>

### 5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion

### 6- Student Assessment methods:

Written exams to assess: a1, a2, a3, b1, b2

Oral exam to assess: a1, a2, a3, b1, b2, d1

Activities to assess: b1, b2, d1

### **Assessment schedule:**

<b>Assessment (1):</b> Activity	Week 7-15
<b>Assessment (2):</b> Written exam	Week 16
<b>Assessment (3):</b> oral exam	Week 16

### **Weighting of Assessment:**

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
<b>TOTAL</b>	<b>100</b>	<b>100%</b>

## **7- References and books:**

### **A- Essential books:**

Drug Stability: Principles and Practices (Drugs and the Pharmaceutical Sciences) by Jens T. Carstensen and Christopher Rhodes (2000).

### **B- Suggested books:**

Handbook of Stability Testing in Pharmaceutical Development: Regulations, Methodologies, and Best Practices, Kim Huynh-Ba, 389 (2008).

### **C- Websites:**

Pubmed, Sciencedirect, Wileyinterscience

### **Facilities required for teaching and learning:**

1. **For lectures:** Black (white) boards, data show.

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**Course Coordinators: Dr/ Hanaa Abd El-Fattah El-Ghamry**

**Head of Department: Prof Dr/ Mahmoud Abdul-Ghany Mahdy**

**Date: 2012/9/3 تم اعتماد التوصيف بالقسم بتاريخ**



## Course specification of Good practice for analysis of drugs and quality control

### A- Course specifications:

- Program on which the course is given: Master of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmaceutical organic chemistry
- Department offering the course: Medicinal chemistry Dept.
- Date of specification approval: 2012/2013

### 1- Basic information:

Title: **Quality in Instrumental Analysis and Quality Control**

Code: ME3

Lectures: 4 hrs/week

Credit hours: 4 hrs/week

Total: 4 hrs/week

### 2- Overall aim of the course:

On completion of the course, the students will be able to choose & develop suitable analytical methodology, analyze and find an effective solution for a given complex problem.

### 3. Intended learning outcome s (ILOs) of Good practice for analysis of drugs and quality control

<b>Knowledge and Understanding</b>	
<b>a1</b>	Outline the principles of drug analysis & quality control
<b>a2</b>	Express up-to-date information in the field of drug analysis
<b>a3</b>	Illustrate the basics in quality control & quality assurance
<b>Intellectual skills</b>	
<b>b1</b>	Analyze & evaluate obtained results qualitatively & quantitatively
<b>b2</b>	Evaluate GMP to avoid any hazards
<b>General and Transferable Skills</b>	
<b>d1</b>	Improve professional abilities by evaluation of information from different sources.
<b>d2</b>	Write reports and present it.

### **4. Course Content of Quality in Instrumental Analysis and Quality Control**

<b>Week number</b>	<b>Lecture contents (4hrs/week)</b>
1	Good Manufacture Practice (GMP)
2	Application of quantitative analysis
3	Quality control
4	Quality assurance
5	Applications of Spectrophotometric analysis for dosage forms <b>Activity</b>
6	H1,C13,N15,F19 NMR
7	Advanced techniques in mass spectroscopy
8	Atomic absorption
9	Fluorimetric analysis
10	Radioimmune Assay
11	Electrophoresis
12	GC-MS chemistry <b>Activity</b>
13	Spectrodenistometric (TLC scanner)
14	Forensic chemistry
15	Revision & Open Discussion

**5- Teaching and Learning Methods:**

- Lectures
- Self learning
- Open discussion

**6- Student Assessment methods:**

Written exams to assess: a1, a2, a3,b1,b2,d1&d2

Oral exams to assess: a1, a2, a3,b1,b2,d1&d2

Activities to assess: d1&d2

**Assessment schedule:**

<b>Assessment (1):</b> Activity	Week 5-12
<b>Assessment (2):</b> Written exam	Week 16
<b>Assessment (3):</b> oral exam	Week 16

**Weighting of Assessment:**

<b>Assessment method</b>	<b>Marks</b>	<b>Percentage</b>
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
<b>TOTAL</b>	<b>100</b>	<b>100%</b>

**7- References and books:****A-Scientific papers****B- Essential books:**

Halpern,A in "Experimental physical chemistry"(2007)

Oxtoby,D and Nachtrieb, N in "Principles of Modern chemistry"(2009)

**C- Suggested books**

Garfied, F .M., Klesta ,E and Hirsch, J in" Quality Assurance Principles for Analytical Laboratories"(2011)

**D- Websites:**

<http://www.ncbi.nlm.nih.gov/sites/entrez>

<http://journals.tubitak.gov.tr/chem/index.php>

<http://www.pharmacopoeia.co.uk/>

[www.Pubmed.Com](http://www.Pubmed.Com)

[www.sciencedirect.com](http://www.sciencedirect.com)

**Facilities required for teaching and learning:**

**For lectures:** Black (white) boards, data show.

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- **Course Coordinators: Prof.Dr/ Sobhy ElAdl**  
**Prof.Dr/ Mohammed Baraka**
- **Head of Department: : Prof.Dr/ Mansour Abukull**
- **Date: 2012/9/3 تم اعتماد التوصيف بالقسم بتاريخ**

# Special Courses

# Advanced Organic Chemistry: Structure and Mechanism

## Course specification of Advanced Organic Chemistry: Structure and Mechanism

### A- Course specifications:

- Program on which the course is given: Master of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmaceutical organic chemistry
- Department offering the course: Pharmaceutical organic chemistry
- Date of specification approval: 2012/2013

### 1- Basic information:

Title: **Advanced Organic Chemistry: Structure and Mechanism**

Code: Osp1

Lectures: 4 hrs/week

Credit hours: 4 hrs/week

Total: 4hrs/week

### 2- Overall aim of the course:

On completion of the course, the students will be able to present a broad and fairly detailed view of the core area of organic reactivity and evaluate and use the current literature in organic chemistry in the field of pharmaceutical industry.

### 3. Intended learning outcome s (ILOs) of Advanced Organic Chemistry: Structure and Mechanism :

<b>Knowledge and Understanding</b>	
<b>a1</b>	Outline the basics of chemical bonding and molecular structure, stereochemistry, stereoselectivity, stability and photochemistry.
<b>a2</b>	Point out the mechanism of nucleophilic substitution, polar addition, polar elimination, pericyclic reaction, free radical reactions and photochemical reaction.
<b>a3</b>	Explain the criteria of aromaticity and outline its utility.
<b>Intellectual skills</b>	
<b>b1</b>	Propose a mechanism for a given reaction.
<b>b2</b>	Determine the number of stereo isomers for a given organic compound.
<b>b3</b>	Find out whether a given cyclic compound is aromatic, non-aromatic or anti-aromatic.
<b>General and Transferable Skills</b>	
<b>d1</b>	Contact effectively with professionals.
<b>d2</b>	Deals with computer and internet skills.
<b>d3</b>	Restore information from different sources.
<b>d4</b>	Run time successfully.
<b>d5</b>	Get independent learning.

### **4. Course Content:**

<b>Week number</b>	<b>Lecture contents (4hrs/week)</b>
<b>1</b>	Valence bond and molecular orbital theories
<b>2</b>	Factors affecting molecular structure
<b>3</b>	Stereochemistry and conformation
<b>4</b>	Stereoselectivity
<b>5</b>	Structural effects on stability and reactivity
<b>6</b>	Nucleophilic substitution
<b>7</b>	Polar addition and elimination reaction
<b>8</b>	Carbanions and other carbon nucleophile
<b>9</b>	Addition, condensation and substitution reactions of carbonyl compounds <b>(Activity, seminar)</b>
<b>10</b>	Aromaticity



<b>11</b>	Aromatic substitution
<b>12</b>	Concerted pericyclic reaction
<b>13</b>	Free radical reaction
<b>14</b>	Photochemistry
<b>15</b>	Illustrative examples for stability of organic pharmaceuticals

### 5- Teaching and Learning Methods:

- Lectures
- Self learning
- noissucsid nepO

### 6- Student Assessment methods:

Written exam assess: a1, a2, a3, b1, b2, b3

Oral exam assess: a1, a2, a3, b1, b2, b3

Activity assess: d1, d2, d3, d4, d5

### **Assessment schedule:**

<b>Assessment (1):</b> Activity	Week 9
<b>Assessment (2):</b> Written exam	Week 16
<b>Assessment (3):</b> oral exam	Week 16

### **Weighting of Assessment:**

<b>Assessment method</b>	<b>Marks</b>	<b>Percentage</b>
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
<b>TOTAL</b>	<b>100</b>	<b>100%</b>

## **7- References and books:**

### **A-Scientific papers**

### **B- Essential books:**

Advanced organic chemistry- Carry & Sunberg Part I

### **Facilities required for teaching and learning:**

1. **For lectures:** Black (white) boards, computer, data show.
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- **Course Coordinators: Pro.Dr. / Eatedal H. Abd El-aal**
- **Head of Department: Prof Dr/ Eatedal H. Abd El-aal**
- **Date: 2012-10-22 تم اعتماد التوصيف بمجلس القسم بتاريخ**

### Matrix I of Advanced Organic Chemistry: Structure and Mechanism

Week number	Course Contents	Knowledge and understanding			Intellectual skills			General and Transferable Skills					
		a1	a2	a3	b1	b2	b3	d1	d2	d3	d4	d5	
1	Valence bond and molecular orbital theories	X											
2	Factors affecting molecular structure	X											
3	Stereochemistry and conformation	X				x							
4	Stereoselectivity	X				x							
5	Structural effects on stability and reactivity	X											
6	Nucleophilic substitution		X		x								
7	Polar addition and elimination reaction		X		x								
8	Carbanions and other carbon nucleophile		X		x								
9	Addition, condensation and substitution reactions of carbonyl compounds (Activity, seminar)		X		x			X	X	X	X	X	
10	Aromaticity			x			x						
11	Aromatic substitution		X		x								
12	Concerted pericyclic reaction		X		x								
13	Free radical reaction		X		x								
14	Photochemistry	X			x								
15	Illustrative examples for stability of organic pharmaceuticals			x									

Matrix II of Advanced Organic Chemistry: Structure and Mechanism										
NARS		Program ILOs	Course ILOs	Course content	Source	Teaching and learning methods		Method of Assessment		
						Lectures	Self learning	Written	Oral	Activity
Knowledge and Understanding	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.1- Demonstrate the principles of advanced organic chemistry and its related subjects including advanced heterocyclic chemistry,	a1	.Valence bond and molecular orbital theories .Factors affecting molecular structure .Stereochemistry and conformation .Stereoselectivity .Structural effects on stability and reactivity .Photochemistry	Scientific papers, text books and Internet	x	x	X	X	

		fundamentals of combinatorial chemistry and organic chemistry of drug synthesis.	a2	.Nucleophilic substitution .Polar addition and elimination reactions .Carbanions and other carbon nucleophiles .Addition, condensation and substitution reactions of carbonyl compounds .Aromatic substitution .Concerted pericyclic reactions .Free radical reactions	Scientific papers, text books and Internet	x	x	x	x	
			a3	.Aromaticity .Illustrative examples for stability of organic pharmaceuticals	Scientific papers, text books and Internet	x	x	x	x	
Intellectual Skills	2.2.2- Solve specified problems in the lack or missing of some information.	B.2- Employ the available data to predict the synthetic pathways and mechanisms.	b1	Nucleophilic substitution- Polar addition and elimination reaction- Carbanions and other carbon nucleophile- Addition, condensation and substitution reactions of carbonyl compounds- Aromatic substitution- Concerted pericyclic reaction- Free radical reaction- Photochemistry	Scientific papers, text books and Internet	x	x	x	x	

	2.2.3-Correlate and integrate different pharmaceutical knowledge to solve professional problems.	B.3- Evaluate the expected problems and side reactions that might emerge during the synthesis and successfully find out the necessary precautions for the recovery of a pure target.	b2	Stereochemistry and conformation- Stereoselectivity	Scientific papers, text books and Internet	x	x	x	x	
	2.2.5- Evaluate and manage risks and potential hazards in professional practices in the area of specialization	B.5-Manage risks during dealing with chemical reagents	b3	Aromaticity	Scientific papers, text books and Internet	x	x	x	x	
General and Transferable Skills	2.4.1- Communicate effectively.	D.1- Contact effectively with professionals.	d1	Activity	Scientific papers, text books and Internet		X			X

<b>General and Transferable Skills</b>	2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.	d2	Activity	Scientific papers, text books and Internet		X			X
	2.4.4- Use variable sources to get information and knowledge.	D.4- Restore information from different sources in the field of advanced organic chemistry.	d3	Activity	Scientific papers, text books and Internet		X			X
	2.4.7- Manage time effectively.	D.7- Run time successfully to get goals.	d4	Activity	Scientific papers, text books and Internet		X			X
	2.4.8- Continuous and self learning.	D.8- Get independent learning for research studies.	d5	Activity	Scientific papers, text books and Internet		X			X

# Advanced Organic Chemistry: Reactions and Synthesis



## Course specification of Advanced Organic Chemistry: Reactions and Synthesis

### A- Course specifications:

- Program on which the course is given: Master of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmaceutical organic chemistry
- Department offering the course: Pharmaceutical organic chemistry
- Date of specification approval: 2012/2013

### 1- Basic information:

Title: **Advanced Organic Chemistry: Reactions and Synthesis**

Code: Osp2

Lectures: 4 hrs/week

Credit hours: 4 hrs/week

Total: 4hrs/week

### 2- Overall aim of the course:

On completion of the course, the students will be able to design efficient pathways for multistep pharmaceutical organic synthesis and evaluate current literature in organic chemistry.

### 3. Intended learning outcome s (ILOs) of Advanced Organic Chemistry: Reactions and Synthesis:

<b>Knowledge and Understanding</b>	
a1	Outline regiochemistry of enolate alkylation
a2	Point out functional group interconversion by substitution,including protection and deprotection
a3	Discuss reaction of carbon nucleophiles with carbonyl compounds
a4	Point out various addition,elimination,oxidation,reduction,organometallic reactions
a5	Compare aromatic substitution reactions to aliphatic analogues
a6	Explain the fundamentals of retrosynthesis
<b>Intellectual skills</b>	
b1	Propose a multistep synthetic scheme towards a required target
b2	Recognize the incompatibilities between functional groups during synthesis
b3	Apply retrosynthetic analysis on complex targets
b4	Evaluate the expected problems and side reactions that might emerge during the synthesis and successfully find out the necessary precautions for the recovery of a pure target
<b>General and Transferable Skills</b>	
d1	Contact effectively with professionals.
d2	Deals with computer and internet skills.
d3	Restore information from different sources.
d4	Run time successfully.
d5	Get independent learning.

### **4. Course Content**

<b>Week number</b>	<b>Lecture contents (4hrs/week)</b>
1	Alkylation of enolates and other carbon nucleophiles
2	Reactions of carbon nucleophiles with carbonyl compounds
3	Functional group interconversion by substitution,including protection and deprotection

4	Electrophilic addition to carbon-carbon multiple bonds
5	Reduction of carbon-carbon multiple bonds, carbonyl groups and other functional groups
6	Concerted cycloadditions, unimolecular rearrangement, and thermal eliminations
7	Organometallic compounds of group 1 and 2 metals <b>(Activity, seminar)</b>
8	Reactions involving transition metals
9	Reactions involving carbocations as reactive intermediates
10	Reactions involving carbenes, and radicals as reactive intermediates
11	Aromatic substitution reactions
12	Oxidations
13	Retrosynthetic analysis
14	Synthetic equivalence and control of stereochemistry
15	Illustrative examples for multistep synthesis

### 5- Teaching and Learning Methods:

- Lectures
- Self learning
- noissucid nepO

### 6- Student Assessment methods:

Written exam assess: a1, a2, a3, a4, a5, a6, b1, b2, b3, b4

Oral exam assess: a1, a2, a3, a4, a5, a6, b1, b2, b3, b4

Activity assess: d1, d2, d3, d4, d5

### **Assessment schedule:**

<b>Assessment (1):</b> Activity	Week 7
<b>Assessment (2):</b> Written exam	Week 16

Assessment (3): oral exam	Week 16
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**Weighting of Assessment:**

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
<b>TOTAL</b>	<b>100</b>	<b>100%</b>

**7- References and books:**

**A-Scientific papers**

**B- Essential books:**

Advanced organic chemistry- Carry & Sunberg Part II

**Facilities required for teaching and learning:**

1. **For lectures:** Black (white) boards, computer, data show.
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- **Course Coordinators:** Dr/ Eatedal H. Abd El-aal
- **Head of Department:** Prof Dr/ Eatedal H. Abd El-aal
- **Date:** 2012-10-22 تم اعتماد التوصيف بمجلس القسم بتاريخ

Matrix I of Advanced Organic Chemistry: Reactions and Synthesis																	
Week number	Course Contents	Knowledge and understanding						Intellectual skills				General and Transferable skills					
		a1	a2	a3	a4	a5	a6	b1	b2	b3	b4	d1	d2	d3	d4	d5	
1	Alkylation of enolates and other carbon nucleophiles	x															
2	Reactions of carbon nucleophiles with carbonyl compounds			x													
3	Functional group interconversion by substitution, including protection and deprotection		x														
4	Electrophilic addition to carbon-carbon multiple bonds				x												
5	Reduction of carbon-carbon multiple bonds, carbonyl groups and other functional groups				x												
6	Concerted cycloadditions, unimolecular rearrangement, and thermal eliminations				x												
7	Organometallic compounds of group 1 and 2 metals (Activity, seminar)				x							x	x	x	x	x	
8	Reactions involving transition metals				x												
9	Reactions involving carbocations as reactive intermediates				x												
10	Reactions involving carbenes, and radicals as reactive intermediates				x												
11	Aromatic substitution reactions					X											
12	Oxidations				x												
13	Retrosynthetic analysis					X	x			x							
14	Synthetic equivalence and control of stereochemistry			x						x		x					
15	Illustrative examples for multistep synthesis			x				x	x		x						

Matrix II of Advanced Organic Chemistry: Reactions and Synthesis										
NARS		Program ILOs	Course ILOs	Course content	Source	Teaching and learning methods		Method of Assessment		
						Lectures	Self learning	Written	Oral	Activity
Knowledge and Understanding	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.1-Demonstrate the principles of advanced organic chemistry and its related subjects including advanced heterocyclic chemistry, fundamentals of combinatorial chemistry and organic chemistry of drug synthesis.	a1	Alkylation of enolates and other carbon nucleophiles	Scientific papers, text books and Internet	x	x	x	X	
			a2	Functional group interconversion by substitution, including protection and deprotection	Scientific papers, text books and Internet	x	x	x	X	
			a3	Reactions of carbon nucleophiles with carbonyl compounds- Synthetic equivalence and control of stereochemistry- Illustrative examples for multistep synthesis	Scientific papers, text books and Internet	x	x	x	X	

			a4	Electrophilic addition to carbon-carbon multiple bonds- Reduction of carbon-carbon multiple bonds, carbonyl groups and other functional groups- Concerted cycloadditions, unimolecular rearrangement, and thermal eliminations- Organometallic compounds of group 1 and 2 metals- Reactions involving transition metals- Reactions involving carbocations as reactive intermediates- Reactions involving carbenes, and radicals as reactive intermediates- Oxidations	Scientific papers, text books and Internet	x	x	x	x	
			a5	Aromatic substitution reactions- Retrosynthetic analysis	Scientific papers, text books and Internet	x	x	x	x	
			a6	Retrosynthetic analysis	Scientific papers, text books and Internet	x	x	x	x	

Intellectual Skills	2.2.2- Solve specified problems in the lack or missing of some information.	B.2- Employ the available data to predict the synthetic pathways and mechanisms.	b2	Synthetic equivalence and control of stereochemistry- Illustrative examples for multistep synthesis	Scientific papers, text books and Internet	x	x	x	X	
	2.2.3- Correlate and integrate different pharmaceutical knowledge to solve professional problems.	B.3- Evaluate the expected problems and side reactions that might emerge during the synthesis and successfully find out the necessary precautions for the recovery of a pure target.	b4	Synthetic equivalence and control of stereochemistry- Illustrative examples for multistep synthesis	Scientific papers, text books and Internet	x	x	x	X	
	2.2.6- Plan to improve performance in the field of specialization.	B.6- Improve a laboratory schemes for an advanced organic chemistry issue.	b1	Illustrative examples for multistep synthesis	Scientific papers, text books and Internet	x	x	X	X	
	2.2.7- Professional decision-making in the contexts of diverse disciplines.	B.7- Take professional decisions in proving target compounds.	b3	Retrosynthetic analysis	Scientific papers, text books and Internet	x	x	x	x	



<b>General and Transferable Skills</b>	2.4.1- Communicate effectively.	D.1- Contact effectively with professionals.	d1	Activity	Scientific papers, text books and Internet		x			X
	2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.	d2	Activity	Scientific papers, text books and Internet		x			X
	2.4.4- Use variable sources to get information and knowledge.	D.4- Restore information from different sources in the field of advanced organic chemistry.	d3	Activity	Scientific papers, text books and Internet		x			X
	2.4.7- Manage time effectively.	D7- Run time successfully to get goals.	d4	Activity	Scientific papers, text books and Internet		x			X
	2.4.8- Continuous and self learning.	D8- Get independent learning for research studies.	d5	Activity	Scientific papers, text books and Internet		x			X

# Advanced Heterocyclic Organic Chemistry

## **Course specification of Advanced Heterocyclic Organic Chemistry**

### **A- Course specifications:**

- Program on which the course is given: Master of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmaceutical organic chemistry
- Department offering the course: Pharmaceutical organic chemistry
- Date of specification approval: 2012/2013

### **1- Basic information:**

Title:	<b>Advanced Heterocyclic Organic Chemistry</b>		
Code:	Osp3		
Lectures:	4 hrs/week	Credit hours:	4 hrs/week
Total:	4hrs/week		

### **2- Overall aim of the course:**

On completion of the course, the students will be able to understand the classic and modern methodologies of heterocyclic chemistry in the pharmaceutical organic synthesis.

### 3. Intended learning outcome s (ILOs) of Advanced Heterocyclic Organic Chemistry:

<b>Knowledge and Understanding</b>	
<b>a1</b>	Know the rules of nomenclature and describe structural and spectroscopic properties of heterocycles.
<b>a2</b>	Summarize the ring synthesis of aromatic and non aromatic heterocycles.
<b>a3</b>	Point out the role of heterocycles in biochemistry and medicine.
<b>a4</b>	Discuss various types of reactions with electrophilic, nucleophilic, oxidizing and reducing reagents.
<b>Intellectual skills</b>	
<b>b1</b>	Design effective synthetic routes to the desired heterocyclic pharmaceutical targets.
<b>b2</b>	Estimate the reactivity of electron deficient and electron rich heterocycles.
<b>b3</b>	Employ and modify heterocyclic chemistry literature procedures.
<b>General and Transferable Skills</b>	
<b>d1</b>	Contact effectively with professionals.
<b>d2</b>	Deals with computer and internet skills.
<b>d3</b>	Restore information from different sources.
<b>d4</b>	Run time successfully.
<b>d5</b>	Get independent learning.

### 4. Course Content of Advanced Heterocyclic Organic Chemistry:

<b>Week number</b>	<b>Lecture contents (4hrs/week)</b>
<b>1</b>	Heterocyclic nomenclature
<b>2</b>	Structures and spectroscopic properties of aromatic heterocycles
<b>3</b>	Ring synthesis of five-membered Heteroaromatics

4	Ring synthesis of six-membered Heteroaromatics
5	Ring synthesis of seven-membered Heteroaromatics
6	Typical reactivity of pyridines, quinolines and isoquinolines
7	Typical reactivity of pyrylium and benzopyrylium ions, pyrones and benzopyrones
8	Typical reactivity of the diazine: pyridazine, pyrimidine and pyrazine
9	Typical reactivity of pyrroles, furans and thiophenes <b>(Activity, Report)</b>
10	Benzenellated azoles: reactions and synthesis
11	Heterocycles containing a ring-junction nitrogen (bridgehead compounds)
12	Heterocycles containing more than two heteroatoms
13	Saturated and partially unsaturated heterocyclic compounds: reactions and synthesis
14	Heterocycles in biochemistry and natural products
15	Heterocycles in medicine

### 5- Teaching and Learning Methods:

- Lectures
- Self learning
- noissucsid nepO

### 6- Student Assessment methods:

Written exam assess: a1, a2, a3, a4, b1, b2 and b3

Oral exam assess: a1, a2, a3, a4, b1, b2 and b3

Activity assess: d1, d2, d3, d4 and d5

**Assessment schedule:**

<b>Assessment (1):</b> Activity	Week 9
<b>Assessment (2):</b> Written exam	Week 16
<b>Assessment (3):</b> oral exam	Week 16

**Weighting of Assessment:**

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
<b>TOTAL</b>	<b>100</b>	<b>100%</b>

**7- References and books:**

**A-Scientific papers**

**B- Essential books:**

Heterocyclic chemistry.,John A. Joule,Keith Mills,2009

**C- Suggested books:**

Bioactive heterocycles, R. R. Gupta, 2006.

**D- Websites:**

pubmed, Sciencedirect

**Facilities required for teaching and learning:**

1. **For lectures:** Black (white) boards, computer, data show.
- 

- **Course Coordinators:** Dr/ Eatedal H. Abd El-aal
- **Head of Department:** Prof Dr/ Eatedal H. Abd El-aal
- **Date:** 2012-10-22 تم اعتماد التوصيف بمجلس القسم بتاريخ

Matrix I of Advanced Heterocyclic Organic Chemistry														
Week number	Course Contents	Knowledge and understanding				Intellectual skills			General and Transferable skills					
		a1	a2	a3	a4	b1	b2	b3	d1	d2	d3	d4	d5	
1	Heterocyclic nomenclature	x												
2	Structures and spectroscopic properties of aromatic heterocycles	x												
3	Ring synthesis of five-membered Heteroaromatics		X					x						
4	Ring synthesis of six-membered Heteroaromatics		X					x						
5	Ring synthesis of seven-membered Heteroaromatics		X					x						
6	Typical reactivity of pyridines, quinolines and isoquinolines				X	x	x							
7	Typical reactivity of pyrylium and benzopyrylium ions, pyrones and benzopyrones				X	x	x							
8	Typical reactivity of the diazine: pyridazine, pyrimidine and pyrazine				X	x	x							
9	Typical reactivity of pyrroles, furans and thiophenes (Activity, report)				X	x	x		x	x	x	x	x	x
10	Benzenellated azoles: reactions and synthesis		X											
11	Heterocycles containing a ring-junction nitrogen (bridgehead compounds)		X											
12	Heterocycles containing more than two heteroatoms		X											
13	Saturated and partially unsaturated heterocyclic compounds: reactions and synthesis		X											
14	Heterocycles in biochemistry and natural products			x										
15	Heterocycles in medicine			x										

Matrix II of Advanced Heterocyclic Organic Chemistry										
NARS		Program ILOs	Course ILOs	Course content	Source	Teaching and learning methods		Method of Assessment		
						Lectures	Self learning	Written	Oral	Activity
Knowledge and Understanding	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.1-Demonstrate the principles of advanced organic chemistry and its related subjects including advanced heterocyclic chemistry, fundamentals of combinatorial chemistry and organic chemistry of drug synthesis.	a1	Heterocyclic nomenclature- Structures and spectroscopic properties of aromatic heterocycles	Scientific papers, text books and Internet	x	x	x	X	



			a2	<p>Ring synthesis of five-membered Heteroaromatics- Ring synthesis of six-membered Heteroaromatics- Ring synthesis of seven-membered Heteroaromatics- Benzanellated azoles: reactions and synthesis- Heterocycles containing a ring-junction nitrogen (bridgehead compounds)- Heterocycles containing more than two heteroatoms- Saturated and partially unsaturated heterocyclic compounds: reactions and synthesis</p>	<p>Scientific papers, text books and Internet</p>	x	x	x	X	
			a4	<p>Typical reactivity of pyridines, quinolines and isoquinolines- Typical reactivity of pyrylium and benzopyrylium ions, pyrones and benzopyrones- Typical reactivity of the diazine: pyridazine, pyrimidine and pyrazine- Typical reactivity of pyrroles, furans and thiophenes</p>	<p>Scientific papers, text books and Internet</p>	x	x	x	x	

	2.1.3- Scientific developments in the area of specialization.	A.3- Understand recent applications of organic chemistry in drug synthesis.	a3	Heterocycles in biochemistry and natural products- Heterocycles in medicine	Scientific papers, text books and Internet	x	x	x	x	
Intellectual Skills	2.2.2- Solve specified problems in the lack or missing of some information.	B.2- Employ the available data to predict the synthetic pathways and mechanisms.	b2	Typical reactivity of pyridines, quinolines and isoquinolines- Typical reactivity of pyrylium and benzopyrylium ions, pyrones and benzopyrones- Typical reactivity of the diazine: pyridazine, pyrimidine and pyrazine- Typical reactivity of pyrroles, furans and thiophenes	Scientific papers, text books and Internet	x	x	x	x	
	2.2.3- Correlate and integrate different pharmaceutical knowledge to solve professional problems.	B.3- Evaluate the expected problems and side reactions that might emerge during the synthesis and successfully find out the necessary precautions for the recovery of a pure target.	b1	Typical reactivity of pyridines, quinolines and isoquinolines- Typical reactivity of pyrylium and benzopyrylium ions, pyrones and benzopyrones- Typical reactivity of the diazine: pyridazine, pyrimidine and pyrazine- Typical reactivity of pyrroles, furans and thiophenes	Scientific papers, text books and Internet	x	x	x	x	

<b>General and Transferable Skills</b>	2.2.6- Plan to improve performance in the field of specialization.	B.6- Improve a laboratory schemes for an advanced organic chemistry issue.	b3	Ring synthesis of five-membered Heteroaromatics- Ring synthesis of six-membered Heteroaromatics- Ring synthesis of seven-membered Heteroaromatics	Scientific papers, text books and Internet	x	x	x	x	
	2.4.1- Communicate effectively.	D.1- Contact effectively with professionals.	d1	Activity	Scientific papers, text books and Internet		x			X
	2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.	d2	Activity	Scientific papers, text books and Internet		x			X
	2.4.4- Use variable sources to get information and knowledge.	D.4- Restore information from different sources in the field of advanced organic chemistry.	d3	Activity	Scientific papers, text books and Internet		x			X
	2.4.7- Manage time effectively.	D7- Run time successfully to get goals.	d4	Activity	Scientific papers, text books and Internet		x			X
	2.4.8- Continuous and self learning.	D8- Get independent learning for research studies.	d5	Activity	Scientific papers, text books and Internet		x			X

# Thesis Specification

## Thesis of Master Degree

### A- Thesis specifications:

- **Program on which the course is given:** Master of Pharmaceutical sciences (Pharmaceutical Organic Chemistry)
- **Major or Minor element of program:** Major
- **Department offering the program:** Pharmaceutical Organic Chemistry Dept.
- **Department offering the thesis:** Pharmaceutical Organic Chemistry Dept.
- **Date of specification approval:** 2012/2013

### 1- Basic information:

Title: Master Thesis in Pharmaceutical Organic Chemistry  
Credit hours: 30 hrs

### 2- Overall aim of the thesis:

**On completion of the thesis, the students will be able to:**

- Design a robust study to answer the research question
- Identify and perform different techniques and methods used in the experimental work according to the designed protocol
- Collect all the data needed to answer the research question using the developed study design
- Analyze the results of the study in the light of prior knowledge
- Draw conclusions about the contribution to knowledge made by the study.

### 3- Intended learning outcome's (ILOs):

<b>Knowledge and Understanding</b>	
<b>a1</b>	Understand all required knowledge related to thesis work.
<b>a2</b>	Select the point of the thesis according to the problems present in the community.
<b>a3</b>	Be aware with recent techniques and developments that can be used during study.
<b>a4</b>	Understand any legal aspects related to the thesis work.
<b>a5</b>	Demonstrate GLP and quality assurance related to practical work of the thesis.
<b>a6</b>	Identify and apply scientific experimental ethics.
<b>Intellectual skills</b>	
<b>b1</b>	Analyze and interpret the experimental data in a suitable form to solve the suggested problem.
<b>b2</b>	Apply analysis and predict synthetic pathways to solve the problem understudy.
<b>b3</b>	Integrate all required knowledge to solve problems and side reactions that may rise during practical work.
<b>b4</b>	Conduct a research project and write scientific reports.
<b>b5</b>	Manage risks and hazards during dealing with chemical reagents.
<b>b6</b>	Design a laboratory protocol for the work.
<b>b7</b>	Make decisions related to recent and future studies.
<b>Professional and practical skills</b>	
<b>c1</b>	Perform practical experiments related to the point understudy.
<b>c2</b>	Report the work in a written report.
<b>c3</b>	Asses used methods, tools and instruments in the research.
<b>General and Transferable skills</b>	
<b>d1</b>	Communicate effectively with professionals.
<b>d2</b>	Use information technology in review and thesis preparation.
<b>d3</b>	Evaluate the work and learning needs.
<b>d4</b>	Use various sources to get information about the subject understudy.

<b>d5</b>	Set rules for evaluation and judging others performance.
<b>d6</b>	Work effectively as a member of a team.
<b>d7</b>	Acquire time management skills.
<b>d8</b>	Study independently and plan research studies.

#### 4. Thesis Content:

Steps	Content
1 <sup>st</sup>	<ul style="list-style-type: none"> <li>• Suggest the possible points/ problems of research that the candidate can work on in the frame of the aim of work and choose proper point related to the problems of the community and surrounding environment.</li> <li>• Collect all available information about this subject by all possible means.</li> <li>• Use internet, journals, books and others thesis to get previous and recent information about the subject understudy.</li> <li>• Design the protocol including the steps of work following the suitable timetable.</li> <li>• Increase the awareness of the recent chemical techniques that will be used during practical work and determined by the protocol.</li> <li>• Integrate different knowledge required to solve suggested problem.</li> <li>• Continuous evaluation to the thesis outcome according to the schedule.</li> </ul>
2 <sup>nd</sup>	<ul style="list-style-type: none"> <li>• Identify different practical techniques and methods to assess chemical reactions related to the subject under study.</li> <li>• Evaluate and manage chemical hazards throughout the</li> </ul>

	<p>whole practical work.</p> <ul style="list-style-type: none"> <li>• Organize the experimental work according to the designed protocol.</li> <li>• Apply spectroscopic analysis for the new expected compounds (IR, <sup>1</sup>HNMR, Mass and elemental analysis).</li> <li>• Predict synthetic pathways and mechanisms.</li> <li>• Use all possible means to prove target compounds.</li> <li>• Apply ethical recommendations in all aspects of scientific research e.g. citation, publication.....</li> </ul>
3 <sup>rd</sup>	<ul style="list-style-type: none"> <li>• Select some of the compounds for their pharmacological or microbiological activities.</li> <li>• Interpret the biological results.</li> <li>• Perform statistical analysis and biological correlation for the results.</li> <li>• Present and describe the results graphically.</li> <li>• Understand any legal aspects related to the thesis work especially those related to dealing with chemicals.</li> </ul>
4 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Communicate with supervisors to discuss results.</li> <li>• Work effectively as a member of a team (e.g. Supervisors and various professionals).</li> <li>• Present the results periodically in seminars.</li> <li>• Write scientific reports on the obtained results with conclusive significance.</li> <li>• Discuss obtained results in comparison with pervious literatures.</li> <li>• Suggest possible recommendations based on the outcome</li> </ul>



	<p>of the thesis and decide future plans.</p> <ul style="list-style-type: none"><li>• Present the thesis in a written form.</li><li>• Summarize the thesis in an understandable Arabic language for non professionals.</li><li>• Write references in the required form (Thesis, Paper.....).</li><li>• Demonstrate the thesis in a final power point presentation.</li><li>• Continue self-learning throughout the experimental work and writing scientific papers.</li></ul>
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### **5- Teaching and Learning Methods:**

- Self learning (Activities, Research....)
- Open discussion

### **6- References:**

- **Websites:** Pubmed, Sciencedirect, Wileyinterscience

#### **Facilities required for:**

1. **For practical work:** Heaters with magnetic stirrer- UV lamp- Rotary evaporator- Ice machine- Infrared- <sup>1</sup>HNMR- Mass Spectrometer- Vacuum pump

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- **Head of Department: Prof. Dr. Eatedal H. Abd El-aal**



<b>Master Thesis (Pharmaceutical Organic Chemistry)</b>				
<b>NARS</b>		<b>Program ILOs</b>	<b>Thesis ILOs</b>	<b>Thesis content</b>
<b>Knowledge and Understanding</b>	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.1-Demonstrate the principles of advanced organic chemistry and its related subjects including advanced heterocyclic chemistry, fundamentals of combinatorial chemistry and organic chemistry of drug synthesis.	Understand all required knowledge related to thesis work.	<ul style="list-style-type: none"> <li>• Collect all available information about this subject by all possible means.</li> </ul>
	2.1.2- Mutual influence between professional practice and its impact on the environment.	A.2- Contribute to the development of health care through the synthesis of novel advantageous drug candidates.	Select the point of the thesis according to the problems present in the community.	<ul style="list-style-type: none"> <li>• Suggest the possible points/problems of research that the candidate can work on in the frame of the aim of work and choose proper point related to the problems of the community and surrounding environment.</li> </ul>
	2.1.3- Scientific developments in the area of specialization.	A.3- Understand recent applications of organic chemistry in drug synthesis.	Be aware with recent techniques and developments that can be used during study.	<ul style="list-style-type: none"> <li>• Increase the awareness of the recent chemical techniques that will be used during practical work and determined by the protocol.</li> </ul>

	2.1.4- Moral and legal principles for professional practice in the area of specialization.	A.4- Be aware with the legal authorities for professional practices in advanced organic chemistry.	Understand any legal aspects related to the thesis work.	<ul style="list-style-type: none"> <li>• Understand any legal aspects related to the thesis work especially those related to dealing with chemicals.</li> </ul>
	2.1.5- Principles and the basics of quality in professional practice in the area of specialization.	A.5- Determine the basics to good laboratory practice and quality assurance in advanced organic chemistry.	Demonstrate GLP and quality assurance related to practical work of the thesis.	<ul style="list-style-type: none"> <li>• Identify different practical techniques and methods to assess chemical reactions related to the subject under study.</li> </ul>
	2.1.6- The fundamentals and ethics of scientific research.	A.6- Shows clearly full consciousness of ethics in all aspects of scientific research.	Identify and apply scientific experimental ethics.	<ul style="list-style-type: none"> <li>• Apply ethical recommendations in all aspects of scientific research e.g citation, publication.....</li> </ul>
<b>Intellectual Skills</b>	2.2.1- Analyze and evaluate information in the field of specialization and analogies to solve problems	B.1- Interpret spectroscopic data in a specific and suitable form to identify new organic compounds.	Analyze and interpret the experimental data in a suitable form to solve the suggested problem.	<ul style="list-style-type: none"> <li>• Select some compounds for their pharmacological or microbiological activities.</li> <li>• Interpret the biological results.</li> <li>• Perform statistical analysis and biological correlation for the results.</li> <li>• Present and describe the results graphically.</li> </ul>

	2.2.2- Solve specified problems in the lack or missing of some information.	B.2- Employ the available data to predict the synthetic pathways and mechanisms.	Apply analysis and predict synthetic pathways to solve the problem under study.	<ul style="list-style-type: none"> <li>• Predict synthetic pathways and mechanisms.</li> <li>• Apply spectroscopic analysis for the new expected compounds (IR, <sup>1</sup>HNMR, Mass and elemental analysis.</li> </ul>
	2.2.3- Correlate and integrate different pharmaceutical knowledge to solve professional problems.	B.3- Evaluate the expected problems and side reactions that might emerge during the synthesis and successfully find out the necessary precautions for the recovery of a pure target.	Integrate all required knowledge to solve problems and side reactions that may rise during practical work.	<ul style="list-style-type: none"> <li>• Integrate different knowledge required to solve suggested problem.</li> </ul>
	2.2.4- Conduct research and write scientific report on research specified topics.	B.4- Design full schemes on the obtained results with conclusive significances.	Conduct a research project and write scientific reports.	<ul style="list-style-type: none"> <li>• Write scientific reports on the obtained results with conclusive significance.</li> </ul>
	2.2.5- Evaluate and manage risks and potential hazards in professional practices in the area of specialization	B.5- Manage risks during dealing with chemical reagents	Manage risks and hazards during dealing with chemical reagents.	Evaluate and manage chemical hazards throughout the whole practical work.

	2.2.6- Plan to improve performance in the field of specialization.	B.6- Improve a laboratory schemes for an advanced organic chemistry issue.	Design a laboratory protocol for the work.	<ul style="list-style-type: none"> <li>• Design the protocol including the steps of work following the suitable timetable.</li> <li>Suggest possible recommendations based on the outcome of the thesis and decide future plans.</li> </ul>
	2.2.7- Professional decision-making in the contexts of diverse disciplines.	B.7- Take professional decisions in proving target compounds.	Make decisions related to recent and future studies.	<ul style="list-style-type: none"> <li>•Suggest the possible points/problems of research that the candidate can work on in the frame of the aim of work and choose proper point related to the problems of the community and surrounding environment.</li> <li>-Suggest possible recommendations based on the outcome of the thesis and decide future plans.</li> <li>- Use all possible means to prove target compounds.</li> </ul>

<b>Professional and Practical Skills</b>	2.3.1- Master basic and modern professional skills in the area of specialization.	C.1- Apply professional skills in synthesis and analysis of different pharmaceutical organic compounds.	Perform practical experiments related to the point understudy.	<ul style="list-style-type: none"> <li>• Predict synthetic pathways and mechanisms.</li> <li>• Apply spectroscopic analysis for the new expected compounds (IR, <sup>1</sup>HNMR, Mass and elemental analysis.</li> <li>-Use all possible means to prove target compounds.</li> </ul>
	2.3.2- Write and evaluate professional reports.	C.2- Write down and discuss results in the form of thesis and scientific papers.	Report the work in a written report.	<ul style="list-style-type: none"> <li>• Present the thesis in a written form</li> <li>-Summarize the thesis in an understandable Arabic language for non professionals.</li> <li>• Write references in the required form (Thesis, Paper.....).</li> </ul>
	2.3.3- Assess methods and tools existing in the area of specialization.	C.3- Choose and implement perfectly the proper techniques during practical work .	Asses used methods, tools and instruments in the research.	<ul style="list-style-type: none"> <li>• Identify different practical techniques and methods to assess chemical reactions related to the subject understudy.</li> </ul>
<b>Transfere</b>	2.4.1- Communicate effectively.	D.1- Contact effectively with professionals.	Communicate effectively with professionals.	<ul style="list-style-type: none"> <li>• Communicate with supervisors to discuss results.</li> </ul>

2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.	Use information technology in review and thesis preparation.	<ul style="list-style-type: none"> <li>• Present the results periodically in seminars</li> <li>• Demonstrate the thesis in a final power point presentation.</li> </ul>
2.4.3- Self-assessment and define his personal learning needs.	D.3- Pursuit self estimation in advanced organic chemistry for personal learning needs.	Evaluate the work and learning needs.	<ul style="list-style-type: none"> <li>• Continuous evaluation to the thesis outcome according to the schedule.</li> </ul>
2.4.4- Use variable sources to get information and knowledge.	D.4- Restore information from different sources in the field of advanced organic chemistry	Use various sources to get information about the subject understudy.	<ul style="list-style-type: none"> <li>• Use internet, journals, books and others thesis to get previous and recent information about the subject understudy.</li> </ul>
2.4.5- Set criteria and parameters to evaluate the performance of others	D.5- Apply standards for judging others performance in the field of advanced organic chemistry.	Set rules for evaluation and judging others performance.	<ul style="list-style-type: none"> <li>• Discuss obtained results in comparison with pervious literatures.</li> </ul>
2.4.6- Work in a team and lead teams carrying out various professional tasks.	D.6- Activate working as a member of a team.	Work effectively as a member of a team.	<ul style="list-style-type: none"> <li>• Work effectively as a member of a team (e.g. Supervisors and various professionals).</li> </ul>
2.4.7- Manage time effectively.	D.7- Run time successfully to get goals.	Acquire time management skills.	<ul style="list-style-type: none"> <li>• Organize the experimental work according to the designed protocol.</li> </ul>



	2.4.8- Continuous and self learning.	D.8- Get independent learning for research studies.	Study independently and plan research studies.	<ul style="list-style-type: none"><li>• Continue self-learning throughout the experimental work and writing scientific papers.</li></ul>
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# PhD Degree

# Program Specification

## Program Specification

### A- Basic Information

- 1- **Program title:** PhD. Pharm. Sci Degree in **Pharmaceutical Organic Chemistry**
- 2- **Program type:** Monodisciplinary.
- 3- **Faculty/ University:** Faculty of Pharmacy, Zagazig University
- 4- **Department:** Pharmaceutical Organic Chemistry
- 5- **Coordinator:** Prof. Dr. Eatedal H. Abd El-aal
- 6- **Date of program specification approval:** 2012

### B- Professional Information

#### 1- Program aims:

The PhD program aims to provide **the doctorate** students with a special and advanced education in the field of **Pharmaceutical Organic Chemistry** and to enable them to gain the skills and attitudes required for the responsible practice of **Pharmacy**.

#### 2-Intended Learning Outcomes (ILOs):

The Program provides excellent opportunities for students to demonstrate knowledge and understanding qualities and develop skills appropriate for Pharmaceutical Organic Chemistry PhD of sciences degree.

##### 2-1- Knowledge and Understanding :

**On successful completion of the PhD degree Program, students will be able to:**

A.1- Demonstrate in-depth knowledge and understanding of application of named reactions in pharmaceutical organic synthesis.

A.2-Deal with all fundamentals, methods, techniques, tools and ethics of scientific research.

A.3-Be aware with the legal authorities for professional practices in pharmacy and academic practices.

A.4-Determine the bases of quality assurance in synthetic pharmaceutical organic chemistry.

A.5- Display awareness of all knowledge in both scientific and social community.

### **2-2 - Intellectual Skills:**

**On successful completion of the PhD degree Program, students will be able to:**

B.1- Analyze, evaluate information in the field of synthesis of pharmaceuticals.

B.2- Investigate accurately the practical results and correlate them with the theoretical background to overcome emerging difficulties in the research process.

B.3- Construct an outstanding research study in the field of synthesis of pharmaceutical important compounds.

B.4- Collect all practical and theoretical data to design scientific paper.

B.5- Manage risks during dealing with chemical reagents.

B.6- Improve a laboratory schemes for an advanced organic chemistry issue.

B.7- Take professional and scientific decisions regarding emerging situations and needs in the field of pharmaceutical synthesis.

B.8- Demonstrate creativity and innovation in the field of pharmaceutical organic chemistry.

B.9- Discuss by theoretical evidences the whole work results.

### **2-3 - Professional and Practical Skills:**

**It is intended that, on successful completion of the PhD degree Program, students will be able to:**

- C.1- Perform Professionally high laboratory techniques for synthesis and purification of the target pharmaceuticals.
- C.2- Estimate all data and write professional reports.
- C.3- Select appropriate methods and tools to support goals.
- C.4- Use the most recent techniques to improve performance.
- C.5- Work to enhance professional practices and performance.

### **2-4 - General and Transferable Skills:**

**On successful completion of the PhD degree Program, students will be able to:**

- D.1- Communicate effectively with colleagues and a wider audience in a variety of media.
- D.2- Improve professional practices using the information technology.
- D.3- Guide others to learn and evaluate their performance.
- D.4- Capable to self-evaluation and continue to learn independently to develop professionally.
- D.5- Use computer and internet skills to get information and knowledge.
- D.6- Activate working as a member of a team.
- D.7- Run time successfully to reach goals.

### **3- Academic Standards:**

- NARS (National Academic Reference Standards)

**Matrix:** Comparison between PhD degree program ILOs and the National Academic Reference Standards

<b>NARS vs. Program ILOs for PhD in Pharmaceutical Organic Chemistry</b>		
	<b>NARS</b>	<b>Program ILOs</b>
<b>Knowledge and Understanding</b>	2.1.1- Fundamental and in-depth knowledge and basic theories in the field of specialty and the closely related areas of pharmaceutical sciences.	A.1- Demonstrate in-depth knowledge and understanding of application of named reactions in pharmaceutical organic synthesis.
	2.1.2- Fundamentals, methods, techniques, tools and ethics of scientific research.	A.2-Deal with all fundamentals, methods, techniques, tools and ethics of scientific research.
	2.1.3- The ethical and legal principles in pharmacy and academic practices.	A.3-Be aware with the legal authorities for professional practices in pharmacy and academic practices .
	2.1.4- The principles and bases of quality assurance in professional practice in the field of specialization.	A.4-Determine the bases of quality assurance in synthetic pharmaceutical organic chemistry.
	2.1.5- All relevant knowledge concerning the impact of professional practice on society and environment and the ways of their conservation and development.	A.5- Display awareness of all knowledge in both scientific and social community.

Intellectual Skills	2.2.1- Analyze, evaluate the data in his / her specified area, and utilize them in logical inference processes (induction/deduction).	B.1- Analyze, evaluate information in the field of synthesis of pharmaceuticals.
	2.2.2- Propose solutions to specified problems in the light of the available data (information).	B.2- Investigate accurately the practical results and correlate them with the theoretical background to overcome emerging difficulties in the research process.
	2.2.3- Conduct research studies that add to the current knowledge.	B.3- Construct an outstanding research study in the field of synthesis of pharmaceutical important compounds.
	2.2.4- Formulate scientific papers.	B.4- Collect all practical and theoretical data to design scientific paper.
	2.2.5- Assess hazards and risks in professional practice in his / her area of specialization.	B.5- Manage risks during dealing with chemical reagents.
	2.2.6- Plan to improve performance in the pharmaceutical area of interest.	B.6- Improve a laboratory schemes for an advanced organic chemistry issue.
	2.2.7- Take professional decisions and bears responsibility in wide array of pharmaceutical fields.	B.7- Take professional and scientific decisions regarding emerging situations and needs in the field of pharmaceutical synthesis.



	2.2.8- Be creative and innovative.	B.8- Demonstrate creativity and innovation in the field of pharmaceutical organic chemistry.
	2.2.9- Manage discussions and arguments based on evidence and logic.	B.9- Discuss by theoretical evidences the whole work results.
Professional and Practical Skills	2.3.1- Mastery of basic and modern professional skills in the area of specialization.	C.1- Perform Professionally high laboratory techniques for synthesis and purification of the target pharmaceuticals.
	.3.2- Write and critically evaluate professional reports.	C.2- Estimate all data and write professional reports.
	2.3.3- Evaluate and develop methods and tools existing in the area of specialization.	C.3- Select appropriate methods and tools to support goals.
	2.3.4- Properly use technological means in a better professional practice.	C.4- Use the most recent techniques to improve performance.
	2.3.5- Plan to improve professional practices and to improve the performance of other scholars.	C.5- Work to enhance professional practices and performance.
General and Transferable Skills	2.4.1- Effective communication in its different forms.	D.1- Communicate effectively with colleagues and a wider audience in a variety of media.

2.4.2- Efficiently use the information technologies (IT) in improving the professional practices.	D.2- Improve professional practices using the information technology.
2.4.3- Help others to learn and evaluate their performance.	D.3- Guide others to learn and evaluate their performance.
2.4.4- Self- assessment and continuous learning.	D.4- Capable to self-evaluation and continue to learn independently to develop professionally.
2.4.5- Use various sources to get information and knowledge.	D.5- Use computer and internet skills to get information and knowledge.
4.6- Work as a member and lead a team of workers.	D.6- Activate working as a member of a team.
2.4.7- Direct scientific meetings and to manage time effectively.	D.7- Run time successfully to reach goals.

#### 4-Curriculum Structure and Contents:

**a- Program duration:** 3- 5 years

**b- Program structure:**

- The PhD program can be completed in 3-5 years.
- The Faculty of pharmacy implements the credit hour system.
- The program is structured as:

**1- Courses:**

**No. of credit hours for program courses:**

Special: (3x4) 12

**2- Thesis:** 30 hours

The candidate must complete a research project on an approved topic in the Pharmaceutical Sciences. To fulfill this requirement the student must present (written and orally) a research proposal and write a thesis.

**3- General University Requirements:** 10 credit hours including:

a- TOEFL (500 units)

b- Computer course

**c-Program Curriculum:**

Course Code	Course Title	Credit hours	Program ILOs Covered
	Special Courses:		
Osp4	Strategic application of named reaction in pharmaceutical organic synthesis	4	A1, B2, B5, D1, D2, D4, D6, D8
Osp5	The Organic Chemistry in Drug Synthesis	4	A1, B2, B3, D2, D4, D6, D8
Osp6	Current Trends in Pharmaceutical Organic Chemistry	4	A1, A2, A3, B6 , B7, D2, D4, D6, D8

	Thesis	30	A1, A2, A3, A4, A5, B1, B2, B3, B4, B5, B6, B7, B8, B9, C1, C2, C3,C4, C5, D1, D2, D3, D4, D5, D6 and D7

### 5-Program admission requirements:

- Candidate should have obtained the certificate of Master degree in pharmaceutical sciences in the same specialty from one of the Egyptian universities or an equivalent certificate from a foreign institute recognized by the university.

### 6- Admission Policy:

The faculty complies with the admission regulations and requirements of the Egyptian Supreme Council of Universities (ESCU).

### 7-Student assessment methods:

Method	ILOS
Written exam	Knowledge and Understanding and Intellectual Skills
Oral exam	Knowledge and Understanding ,Intellectual Skills

	and General and Transferable Skills
Activity	Intellectual Skills and General and Transferable Skills
Seminars	Knowledge and Understanding ,Intellectual Skills & General and Transferable Skills
Follow up	Professional and practical Skills & General and Transferable Skills
Thesis and oral presentation	Knowledge and Understanding, Intellectual Skills, Professional and practical Skills & General and Transferable Skills

Grade Scale	Grade point average value (GPA)	Numerical scale
A+	5	≥ 95%
A	4.5	90- < 95%
B+	4	85- < 90%
B	3.5	80- < 85%
C+	3	75- < 80%
C	2.5	70- < 75%
D+	2	65- < 70%
D	1.5	60- < 65%

### 8-Failure in Courses:

Students who fail to get 60% (1 point)

## 9-Methods of program evaluation

<b>Evaluator</b>	<b>Method</b>	<b>Sample</b>
<b>Internal evaluator:</b> Professor Dr. Eatedal Hassan	Program evaluation Courses evaluation	Program report Courses report
<b>External evaluator:</b> Professor Dr. Fatma Elnabaweya Goda	Program evaluation Courses evaluation	Program report Courses report
<b>Others methods</b>	Matrix with NARS Questionnaires	The Matrix Results of the questionnaires

**Program coordinator**

**Prof. DrAzza Kadary**

**Head of Department**

**Prof. Dr. Eatedal H. Abd El-aal**

**Strategic  
Application of  
Named Reaction  
in  
Pharmaceutical  
Organic  
Synthesis**

## Course specification of Strategic Application of named reaction in pharmaceutical organic synthesis

### A- Course specifications:

- Program on which the course is given: PhD of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmaceutical organic chemistry
- Department offering the course: Pharmaceutical organic chemistry
- Date of specification approval: 2012/2013

### 1- Basic information:

Title: **Strategic application of named reaction in pharmaceutical organic synthesis**

Code: Osp4

Lectures: 4 hrs/week

Credit hours: 4 hrs/week

Total: 4hrs/week

### 2- Overall aim of the course:

On completion of the course, the students will be able to identify various named organic reactions, verify the mechanism of several named reactions and apply the named reactions in the synthesis of some pharmaceutically active compounds.



### 3. Intended learning outcome s (ILOs)

<b>Knowledge and Understanding</b>	
<b>a1</b>	Enumerate various applicable named organic reactions.
<b>a2</b>	Describe the mechanisms of different named reactions.
<b>a3</b>	Mention different synthetic examples related to named reactions.
<b>Intellectual skills</b>	
<b>b1</b>	Predict the mechanism of named reactions.
<b>b2</b>	Evaluate the role of each reagent in a given named reactions.
<b>General and Transferable skills</b>	
<b>d1</b>	Contact effectively with professionals.
<b>d2</b>	Deals with computer and internet skills.
<b>d3</b>	Restore information from different sources.
<b>d4</b>	Run time successfully.
<b>d5</b>	Get independent learning.

### 4. Course Content

<b>Week number</b>	<b>Lecture contents (4hrs/week)</b>
<b>1</b>	Named reactions starting with the letters A&B
<b>2</b>	Named reactions starting with the letters C&D
<b>3</b>	Named reactions starting with the letters E&F
<b>4</b>	Named reactions starting with the letters G&H
<b>5</b>	Named reactions starting with the letters I&J
<b>6</b>	Named reactions starting with the letter K
<b>7</b>	Named reactions starting with the letter L <b>(Activity)</b>
<b>8</b>	Named reactions starting with the letter M
<b>9</b>	Named reactions starting with the letter N
<b>10</b>	Named reactions starting with the letter O
<b>11</b>	Named reactions starting with the letters P&Q
<b>12</b>	Named reactions starting with the letter R
<b>13</b>	Named reactions starting with the letter S
<b>14</b>	Named reactions starting with the letters

	T,U,V,&W
15	Named reactions starting with the letters X,Y,&Z

### 5- Teaching and Learning Methods:

- Lectures
- Self learning
- noissucsid nepO

### 6- Student Assessment methods:

Written exams assess: a1, a2, a3, b1, b2

Oral exam assess: a1, a2, a3, b1, b2

Activity assess: d1, d2, d3, d4, d5

#### **Assessment schedule:**

<b>Assessment (1):</b> Activity	Week 7
<b>Assessment (2):</b> Written exam	Week 16
<b>Assessment (3):</b> oral exam	Week 16

#### **Weighting of Assessment:**

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
<b>TOTAL</b>	<b>100</b>	<b>100%</b>

### 7- References and books:

#### **A-Scientific papers**

#### **B- Essential books:**

Strategic application of named reactions in organic synthesis

**Facilities required for teaching and learning:**

1. **For lectures:** Black (white) boards, computer, data show.
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- **Course Coordinators:** Prof. Dr/ Eatedal H. Abd El-aal
- **Head of Department:** Prof. Dr/ Eatedal H. Abd El-aal
- **Date:** 2012-10-22 تم اعتماد التوصيف بمجلس القسم بتاريخ

<b>Matrix I of Strategic Application of Named Reaction in Pharmaceutical Organic Synthesis</b>											
Week number	Course Contents	Knowledge and understanding			Intellectual skills		General and Transferable skills				
		a1	a2	a3	b1	b2	d1	d2	d3	d4	d5
1	Named reactions starting with the letters A&B	x	x	x	X	x					
2	Named reactions starting with the letters C&D	x	x	x	X	x					
3	Named reactions starting with the letters E&F	x	x	x	X	x					
4	Named reactions starting with the letters G&H	x	x	x	X	x					
5	Named reactions starting with the letters I&J	x	x	x	X	x					
6	Named reactions starting with the letter K	x	x	x	X	x					
7	Named reactions starting with the letter L	x	x	x	X	x	x	x	x	X	x
8	Named reactions starting with the letter M	x	x	x	X	x					
9	Named reactions starting with the letter N	x	x	x	X	x					
10	Named reactions starting with the letter O	x	x	x	X	x					
11	Named reactions starting with the letters P&Q	x	x	x	X	x					
12	Named reactions starting with the letter R	x	x	x	X	x					
13	Named reactions starting with the letter S	x	x	x	X	x					
14	Named reactions starting with the letters T,U,V,&W	x	x	x	X	x					
15	Named reactions starting with the letters X,Y,&Z	x	x	x	X	x					

## Matrix II of Strategic Application of Named Reaction in Pharmaceutical Organic Synthesis

NARS		Program ILOs	Course ILOs	Course content	Source	Teaching and learning methods			Activity	
						Lectures	Self learning	Written exam		Oral exam
Knowledge and Understanding	2.1.1- Fundamental and in-depth knowledge and basic theories in the field of specialty and the closely related areas of pharmaceutical sciences.	A.1- Demonstrate in-depth knowledge and understanding of application of named reactions in pharmaceutical organic synthesis.	a1	Named reactions starting with the letters A,B,C,D,E,F,G,H,I,G,K,L,M,N,O,P,Q,R,S,T,U, V,W,X,Y,Z	Scientific papers, text books and Internet	x	x	x	X	
			a2	Named reactions starting with the letters A,B,C,D,E,F,G,H,I,G,K,L,M,N,O,P,Q,R,S,T,U, V,W,X,Y,Z	Scientific papers, text books and Internet	x	x	x	X	
			a3	Named reactions starting with the letters A,B,C,D,E,F,G,H,I,G,K,L,M,N,O,P,Q,R,S,T,U, V,W,X,Y,Z	Scientific papers, text books and Internet	x	x	x	X	

Intellectual Skills	2.2.2- Propose solutions to specified problems in the light of the available data (information).	B.2- Investigate accurately the practical results and correlate them with the theoretical background to overcome emerging difficulties in the research process.	b1	Named reactions starting with the letters A,B,C,D,E,F,G,H,I,G,K,L,M,N,O,P,Q,R,S,T,U, V,W,X,Y,Z	Scientific papers, text books and Internet	x	x	x	X	
	2.2.5- Assess hazards and risks in professional practice in his / her area of specialization.	B.5- Manage risks during dealing with chemical reagents.	b2	Named reactions starting with the letters A,B,C,D,E,F,G,H,I,G,K,L,M,N,O,P,Q,R,S,T,U, V,W,X,Y,Z	Scientific papers, text books and Internet	x	x	x	x	
General and Transferable skills	2.4.1- Communicate effectively.	D.1- Contact effectively with professionals.	d1	Activity	Scientific papers, text books and Internet		x			X

2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.	d2	Activity	Scientific papers, text books and Internet		x			X
2.4.4- Use variable sources to get information and knowledge.	D.4- Restore information from different sources in the field of advanced organic chemistry.	d3	Activity	Scientific papers, text books and Internet		x			X
2.4.7- Manage time effectively.	D7- Run time successfully to get goals.	d4	Activity	Scientific papers, text books and Internet		x			X
2.4.8- Continuous and self learning.	D8- Get independent learning for research studies.	d5	Activity	Scientific papers, text books and Internet		x			X

# The Organic Chemistry in Drug Synthesis



## Course specification of The Organic Chemistry in Drug Synthesis

### A- Course specifications:

- Program on which the course is given: PhD of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmaceutical organic chemistry
- Department offering the course: Pharmaceutical organic chemistry
- Date of specification approval: 2012/2013

### 1- Basic information:

Title: **The Organic Chemistry in Drug Synthesis**

Code: Osp5

Lectures: 4 hrs/week

Credit hours: 4 hrs/week

Total: 4hrs/week

### 2- Overall aim of the course:

On completion of the course, the students will be able to outline the synthesis of most of the drugs and demonstrate a strong ability to undergo synthetic organic chemistry with some exposure to modern biology.

### 3. Intended learning outcome s (ILOs) of The Organic Chemistry in Drug Synthesis:

<b>Knowledge and Understanding</b>	
<b>a1</b>	Outline synthetic routes toward aliphatic, aromatic and heterocyclic drugs.
<b>a2</b>	Point out the importance of aliphatic, aromatic and heterocyclic moieties as cores for therapeutic agents.
<b>Intellectual skills</b>	
<b>b1</b>	Propose a facile route to know drugs.
<b>b2</b>	Evaluate the role that heterocyclic moieties play in the biological activity beyond simply providing a basic center for a good many agents.
<b>General and Transferable skills</b>	
<b>d1</b>	Contact effectively with professionals.
<b>d2</b>	Deals with computer and internet skills.
<b>d3</b>	Restore information from different sources.
<b>d4</b>	Run time successfully.
<b>d5</b>	Get independent learning.

### 4. Course Content of The Organic Chemistry in Drug Synthesis:

<b>Week number</b>	<b>Lecture contents (4hrs/week)</b>
<b>1</b>	Open-chain compounds
<b>2</b>	Alicyclic compounds
<b>3</b>	Compounds related to progesterone, cortisone and cholesterol
<b>4</b>	Monocyclic aromatic compounds
<b>5</b>	Carbocyclic compounds fused to benzene ring
<b>6</b>	Five-membered heterocycles
<b>7</b>	Six-membered heterocycles <b>(Activity)</b>
<b>8</b>	Five-membered heterocycles fused to one benzene ring
<b>9</b>	Six-membered heterocycles fused to one benzene ring
<b>10</b>	Bicyclic fused heterocycles

<b>11</b>	Polycyclic fused heterocycles
<b>12</b>	Opioid analgesics
<b>13</b>	Seven-membered heterocycles fused to benzene ring
<b>14</b>	Heterocycles fused to two aromatic rings
<b>15</b>	Beta lactam antibiotics

### 5- Teaching and Learning Methods:

- Lectures
- Self learning
- noissucsid nepO

### 6- Student Assessment methods:

Written exams assess: a1, a2, b1, b2

Oral exam assess: a1, a2, b1, b2,

Activity assess: d1, d2, d3, d4, d5

#### **Assessment schedule:**

<b>Assessment (1):</b> Activity	Week 7
<b>Assessment (2):</b> Written exam	Week 16
<b>Assessment (3):</b> oral exam	Week 16

#### **Weighting of Assessment:**

<b>Assessment method</b>	<b>Marks</b>	<b>Percentage</b>
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
<b>TOTAL</b>	<b>100</b>	<b>100%</b>

## 7- References and books:

### A-Scientific papers

### B- Essential books:

The organic chemistry in drug synthesis, Daniel Lednicer 2007

### C-Suggested books:

Principle of organic medicine chemistry, Rama Rao Nadendla, 2005

### D- Websites: pubmed, Sciencedirect

### Facilities required for teaching and learning:

1. **For lectures:** Black (white) boards, computer, data show.
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- **Course Coordinators: Prof.Dr/ Eatedal H.Abd El-aal**
- **Head of Department: Prof Dr/ Eatedal H.Abd El-aal**
- **Date: 2012-10-22 تم اعتماد التوصيف بمجلس القسم بتاريخ**

<b>Matrix I of The Organic Chemistry in Drug Synthesis</b>										
Week number	Course Contents	Knowledge and understanding		Intellectual skills		General and Transferable skills				
		a1	a2	b1	b2	d1	d2	d3	d4	d5
1	Open-chain compounds	x								
2	Alicyclic compounds	x								
3	Compounds related to progesterone, cortisone and cholesterol		x	X						
4	Monocyclic aromatic compounds	x								
5	Carbocyclic compounds fused to benzene ring	x								
6	Five-membered heterocycles	x								
7	Six-membered heterocycles	x				x	x	x	x	x
8	Five-membered heterocycles fused to one benzene ring	x								
9	Six-membered heterocycles fused to one benzene ring	x								
10	Bicyclic fused heterocycles	x								
11	Polycyclic fused heterocycles	x								
12	Opioid analgesics		x		x					
13	Seven-membered heterocycles fused to benzene ring	x								
14	Heterocycles fused to two aromatic rings	x								
15	Beta lactam antibiotics		x		x					

## Matrix II of The Organic Chemistry in Drug Synthesis

NARS		Program ILOs	Course ILOs	Course content	Source	Teaching and learning methods		Method of Assessment		
						Lectures	Self learning	Written exam	Oral exam	Activity
Knowledge and Understanding	2.1.1- Fundamental and in-depth knowledge and basic theories in the field of specialty and the closely related areas of pharmaceutical sciences.	A.1- Demonstrate in-depth knowledge and understanding of application of named reactions in pharmaceutical organic synthesis.	a1	Open-chain compounds- Alicyclic compounds- Monocyclic aromatic compounds- Carbocyclic compounds fused to benzene ring- Five-membered heterocycles- Six-membered heterocycles- Five-membered heterocycles fused to one benzene ring- Six-membered heterocycles fused to one benzene ring- Bicyclic fused heterocycles- Polycyclic fused heterocycles- Seven-membered heterocycles fused to benzene ring- Heterocycles fused to two aromatic rings	Scientific papers, text books and Internet	x	x	x	x	
			a2	Compounds related to progesterone, cortisone and cholesterol- Opioid analgesics- Beta lactam antibiotics	Scientific papers, text books and Internet	x	x	x	x	
Intellectual Skills	2.2.1- Analyze, evaluate the data in his / her specified area, and utilize them in logical inference processes (induction/ded	B.1- Analyze, evaluate information in the field of synthesis of pharmaceuticals.	b1	Compounds related to progesterone, cortisone and cholesterol	Scientific papers, text books and Internet	x	x	x	x	

	uction).									
	2.2.3- Conduct research studies that add to the current knowledge.	B.3- Construct an outstanding research study in the field of synthesis of pharmaceutical important compounds.	b2	Opioid analgesics- Beta lactam antibiotics	Scientific papers, text books and Internet	x	x	x	x	
General and Transferable skills	2.4.1- Communicate effectively.	D.1- Contact effectively with professionals.	d1	Activity	Scientific papers, text books and Internet		x			X
	2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.	d1	Activity	Scientific papers, text books and Internet		x			X
	2.4.4- Use variable sources to get information and	D.4- Restore information from different sources in the field of advanced organic	d1	Activity	Scientific papers, text books and Internet		x			X

	knowledge.	chemistry.								
	2.4.7- Manage time effectively.	D7- Run time successfully to get goals.	d1	Activity	Scientific papers, text books and Internet		x			X
	2.4.8- Continuous and self learning.	D8- Get independent learning for research studies.	d1	Activity	Scientific papers, text books and Internet		x			X



# Current Trends in Pharmaceutical Organic Chemistry

## Course specification of Current Trends in Pharmaceutical Organic Chemistry

### A- Course specifications:

- Program on which the course is given: PhD of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmaceutical organic chemistry
- Department offering the course: Pharmaceutical organic chemistry
- Date of specification approval: 2012/2013

### 1- Basic information:

Title: **Current Trends in Pharmaceutical Organic Chemistry**

Code: Osp6

Lectures: 4 hrs/week

Credit hours: 4 hrs/week

Total: 4hrs/week

### 2- Overall aim of the course:

On completion of the course, the students will be able to apply combinatorial chemistry in the synthesis of drug libraries and utilize click chemistry in pharmaceutical organic synthesis.

### 3. Intended learning outcome s (ILOs) of Current Trends in Pharmaceutical Organic Chemistry:

<b>Knowledge and Understanding</b>	
<b>a1</b>	Illustrate the fundamentals of combinatorial chemistry and outline the operating principles associated with its most widely practiced forms.
<b>a2</b>	Point out the use of combinatorial chemistry technologies in pharmaceutical applications.
<b>a3</b>	Define the concept of click chemistry and demonstrate its potential value as a universal ligation strategy for drug synthesis and material science.
<b>Intellectual skills</b>	
<b>b1</b>	Recognize combinatorial chemistry as a powerful tool for drug discovery.
<b>b2</b>	Consider the use of click chemistry in drug synthesis.
<b>General and Transferable skills</b>	
<b>d1</b>	Contact effectively with professionals.
<b>d2</b>	Deals with computer and internet skills.
<b>d3</b>	Restore information from different sources.
<b>d4</b>	Run time successfully.
<b>d5</b>	Get independent learning.

### 4. Course Content of Current Trends in Pharmaceutical Organic Chemistry:

<b>Week number</b>	<b>Lecture contents (4hrs/week)</b>
<b>1</b>	Introduction to combinatorial chemistry
<b>2</b>	Solid phase polymers for combinatorial chemistry
<b>3</b>	Linkers for solid phase synthesis
<b>4</b>	Encoding technologies
<b>5</b>	Instrumentation for combinatorial chemistry
<b>6</b>	Radical reactions in combinatorial chemistry
<b>7</b>	Nucleophilic substitution in combinatorial and

	solid phase synthesis <b>(Activity)</b>
<b>8</b>	Electrophilic substitution in combinatorial and solid phase synthesis
<b>9</b>	Elimination chemistry in the solution and solid phase synthesis
<b>10</b>	Combinatorial chemistry of the carbonyl group
<b>11</b>	Pharmaceutical applications of combinatorial chemistry
<b>12</b>	Introduction to click chemistry
<b>13</b>	Copper catalyzed click chemistry
<b>14</b>	Non-copper catalyzed click chemistry
<b>15</b>	Pharmaceutical applications of click chemistry

### **5- Teaching and Learning Methods:**

- Lectures
- Self learning
- noissucsid nepO

### **6- Student Assessment methods:**

Written exams assess: a1, a2, a3, b1, b2

Oral exam assess: a1, a2, a3, b1, b2

Activity assess: d1, d2, d3, d4, d5

#### **Assessment schedule:**

<b>Assessment (1):</b> Activity	Week 7
<b>Assessment (2):</b> Written exam	Week 16
<b>Assessment (3):</b> oral exam	Week 16

#### **Weighting of Assessment:**

Assessment method	Marks	Percentage
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• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
<b>TOTAL</b>	<b>100</b>	<b>100%</b>

## 7- References and books:

### A-Scientific papers

### B- Essential books:

- Combinatorial chemistry synthesis, analysis and screening.
- Click chemistry for Biotechnology and Materials sciences.

### Facilities required for teaching and learning:

1. **For lectures:** Black (white) boards, computer, data show.

- **Course Coordinators:** Prof.Dr/ Eatedal H.Abd El-aal
- **Head of Department:** Prof Dr/ Eatedal H.Abd El-aal
- **Date:** 2012-10-22 تم اعتماد التوصيف بمجلس القسم بتاريخ

Matrix I of Current Trends in Pharmaceutical Organic Chemistry												
Week number	Course Contents	Knowledge and understanding			Intellectual skills		General and Transferable skills					
		a1	a2	a3	b1	b2	d1	d2	d3	d4	d5	
1	Introduction to combinatorial chemistry	x			x							
2	Solid phase polymers for combinatorial chemistry	x	x	x	x							
3	Linkers for solid phase synthesis	x	x		x							
4	Encoding technologies	x	x		x							
5	Instrumentation for combinatorial chemistry	x	x		x							
6	Radical reactions in combinatorial chemistry	x			x							
7	Nucleophilic substitution in combinatorial and solid phase synthesis	x			x		x	x	x	x	x	
8	Electrophilic substitution in combinatorial and solid phase synthesis	x			x							
9	Elimination chemistry in the solution and solid phase synthesis	x			x							
10	Combinatorial chemistry of the carbonyl group	x			x							
11	Pharmaceutical applications of combinatorial chemistry	x			x							
12	Introduction to click chemistry			x		X						
13	Copper catalyzed click chemistry			x		X						
14	Non-copper catalyzed click chemistry			x		X						
15	Pharmaceutical applications of click chemistry			x	x	X						



Matrix II of Current Trends in Pharmaceutical Organic Chemistry										
NARS		Program ILOs	Course ILOs	Course content	Source	Teaching and learning methods		Method of Assessment		
						Lectures	Self learning	Written exam	Oral exam	Activity
Knowledge and Understanding	2.1.1- Fundamental and in-depth knowledge and basic theories in the field of specialty and the closely related areas of pharmaceutical sciences.	A.1- Demonstrate in-depth knowledge and understanding of application of named reactions in pharmaceutical organic synthesis.	a1	Introduction to combinatorial chemistry- Solid phase polymers for combinatorial chemistry- Linkers for solid phase synthesis-Encoding technologies- Instrumentation for combinatorial chemistry- Radical reactions in combinatorial chemistry- Nucleophilic substitution in combinatorial and solid phase synthesis - Electrophilic substitution in combinatorial and solid phase synthesis- Elimination chemistry in the solution and solid phase synthesis- Combinatorial chemistry of the carbonyl group- Pharmaceutical applications of combinatorial chemistry	Scientific papers, text books and Internet	x	x	x	x	



	2.1.2- Fundamentals, methods, techniques, tools and ethics of scientific research.	A.2-Deal with all fundamentals, methods, techniques, tools and ethics of scientific research.	a2	Solid phase polymers for combinatorial chemistry- Linkers for solid phase synthesis-Encoding technologies- Instrumentation for combinatorial chemistry	Scientific papers, text books and Internet	x	x	x	x	
	2.1.3- The ethical and legal principles in pharmacy and academic practices.	A.3-Be aware with the legal authorities for professional practices in pharmacy and academic practices .	a3	Solid phase polymers for combinatorial chemistry- Introduction to click chemistry- Copper catalyzed click chemistry- Non-copper catalyzed click chemistry- Pharmaceutical applications of click chemistry	Scientific papers, text books and Internet	x	x	x	x	
Intellectual Skills	2.2.6- Plan to improve performance in the pharmaceutical area of interest.	B.6- Improve a laboratory schemes for an advanced organic chemistry issue.	b2	Introduction to click chemistry- Copper catalyzed click chemistry- Non-copper catalyzed click chemistry- Pharmaceutical applications of click chemistry	Scientific papers, text books and Internet	x	x	x	x	

	2.2.7- Take professional decisions and bears responsibility in wide array of pharmaceutical fields.	B.7- Take professional and scientific decisions regarding emerging situations and needs in the field of pharmaceutical synthesis.	b1	Introduction to combinatorial chemistry- Solid phase polymers for combinatorial chemistry- Linkers for solid phase synthesis-Encoding technologies- Instrumentation for combinatorial chemistry- Radical reactions in combinatorial chemistry- Nucleophilic substitution in combinatorial and solid phase synthesis - Electrophilic substitution in combinatorial and solid phase synthesis- Elimination chemistry in the solution and solid phase synthesis- Combinatorial chemistry of the carbonyl group- Pharmaceutical applications of combinatorial chemistry- Pharmaceutical applications of click chemistry	Scientific papers, text books and Internet	x	x	x	x	
GTS	2.4.1- Communicate effectively.	D.1- Contact effectively with professionals.	d1	Activity	Scientific papers, text books and Internet		x			X

2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.	d2	Activity	Scientific papers, text books and Internet		x				X
2.4.4- Use variable sources to get information and knowledge .	D.4- Restore information from different sources in the field of advanced organic chemistry.	d3	Activity	Scientific papers, text books and Internet		x				X
2.4.7- Manage time effectively.	D7- Run time successfully to get goals.	d4	Activity	Scientific papers, text books and Internet		x				X
2.4.8- Continuous and self learning.	D8- Get independent learning for research studies.	d5	Activity	Scientific papers, text books and Internet		x				X

# Thesis Specification

## Thesis Specification of PhD Degree

### A- Course specifications:

- **Program on which the course is given:** PhD of Pharmaceutical sciences (Pharmaceutical Organic Chemistry)
- **Major or Minor element of program:** Major
- **Department offering the program:** Pharmaceutical Organic Chemistry Dept.
- **Department offering the thesis:** Pharmaceutical Organic Chemistry Dept.
- **Date of specification approval:** 2012/2013

### 1- Basic information:

Title: PhD Thesis in Pharmaceutical Organic Chemistry

Credit hours: 30 hrs

### 2- Overall aim of the thesis:

**On completion of the thesis, the students will be able to:**

- Outline the possible protocol for solving harsh problem that the candidate can work after integrating suitable knowledge about this point of research
- Identify and perform different techniques and methods used in the experimental work according to the designed protocol
- Derive and present the results of the study from the data collected
- Analyze the results of the study in the light of prior knowledge
- Draw conclusions about the contribution to knowledge made by the study which may be concerned with the problem under investigation, the methods deployed or the student as researcher

**3- Intended learning outcome's (ILOs):**

<b>Knowledge and Understanding</b>	
<b>a1</b>	Illustrate fundamentals and advanced knowledge in the field of Pharmaceutical organic chemistry that help to better understand the subject understudy.
<b>a2</b>	Determine methods, tools and techniques used during work.
<b>a3</b>	Carry out professional duties in accordance with legal and ethical guidelines.
<b>a4</b>	Define and apply quality bases during practical work.
<b>a5</b>	Describe the purpose of the research work and its impact on the community and human health.
<b>Intellectual skills</b>	
<b>b1</b>	Analyze and interpret the experimental data in a suitable form to utilize them properly.
<b>b2</b>	Propose a solution to the point understudy depending on available data.
<b>b3</b>	Carry out the research to add to the area of study.
<b>b4</b>	Develop writing skills such as clarity and presenting results to formulate scientific papers.
<b>b5</b>	Manage risks during dealing with chemical reagents.
<b>b6</b>	Improve the performance during the practical work.
<b>b7</b>	Make decisions related to recent and future studies.
<b>b8</b>	Be creative, innovative and original in one's approach to research.
<b>b9</b>	Discuss by theoretical evidences the whole work results.
<b>Professional and practical skills</b>	
<b>c1</b>	Perform practical experiments related to the point understudy.
<b>c2</b>	Report the work in a written report.
<b>c3</b>	Select appropriate methods and tools to support goals.
<b>c4</b>	Consider developments in technology and how to use to enhance learning.
<b>c5</b>	Improve the performance during the practical work.

General and Transferable skills	
d1	Communicate effectively in different forms.
d2	Be competent in the use of computers for data analysis, word-processing, and production of thesis-quality graphics.
d3	Evaluate the performance of others and assist them to develop.
d4	Recognize self-limitations and areas for improvement and seek for continuous learning.
d5	Gather, summarize, and organize information from different sources.
d6	Implement tasks as a member of a team.
d7	Utilize time effectively to achieve goals.

#### **4. Thesis Content:**

Steps	Content
1 <sup>st</sup>	<ul style="list-style-type: none"> <li>• Suggest the possible points/ problems of research that the candidate can work on in the frame of the aim of work and choose proper point related to the problems of the community and surrounding environment.</li> <li>• Collect all available information about this subject by all possible means.</li> <li>• Use internet, journals, books and others thesis to get previous and recent information about the subject understudy.</li> <li>• Design the protocol including the steps of work following the suitable timetable.</li> <li>• Increase the awareness of the recent chemical techniques that will be used during practical work and determined by the protocol.</li> <li>• Integrate different knowledge required to solve suggested</li> </ul>

	<p>problem.</p> <ul style="list-style-type: none"> <li>• Continuous evaluation to the thesis outcome according to the schedule.</li> </ul>
2 <sup>nd</sup>	<ul style="list-style-type: none"> <li>• Identify different practical techniques and methods to assess chemical reactions related to the subject under study.</li> <li>• Modify methods and experiments used during practical work.</li> <li>• Evaluate and manage chemical hazards throughout the whole practical work.</li> <li>• Organize the experimental work according to the designed protocol.</li> <li>• Apply spectroscopic analysis for the new expected compounds (IR, <sup>1</sup>HNMR, Mass and elemental analysis).</li> <li>• Predict synthetic pathways and mechanisms.</li> <li>• Use all possible means to prove target compounds.</li> <li>• Apply ethical recommendations in all aspects of scientific research e.g. citation, publication.....</li> </ul>
3 <sup>rd</sup>	<ul style="list-style-type: none"> <li>• Select some of the compounds for their pharmacological or microbiological activities.</li> <li>• Interpret the biological results.</li> <li>• Perform statistical analysis and biological correlation for the results.</li> </ul>



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	<ul style="list-style-type: none"><li>• Present and describe the results graphically.</li><li>• Understand any legal aspects related to the thesis work especially those related to dealing with chemicals.</li></ul>
4 <sup>th</sup>	<ul style="list-style-type: none"><li>• Communicate with supervisors to discuss results.</li><li>• Work effectively as a member of a team (e.g. Supervisors and various professionals).</li><li>• Present the results periodically in seminars.</li><li>• Write scientific reports on the obtained results with conclusive significance.</li><li>• Discuss obtained results in comparison with pervious literatures.</li><li>• Suggest possible recommendations based on the outcome of the thesis and decide future plans.</li><li>• Present the thesis in a written form.</li><li>• Summarize the thesis in an understandable Arabic language for non professionals.</li><li>• Write references in the required form (Thesis, Paper.....).</li><li>• Demonstrate the thesis in a final power point presentation.</li><li>• Continue self-learning throughout the experimental work and writing scientific papers.</li></ul>

### 5- Teaching and Learning Methods:

- Self learning (Activities, Research....)
- Open discussion

### 6- References:

- **Websites:** Pubmed, Sciencedirect, Wileyinterscience

#### Facilities required for:

1. **For practical work:** Heaters with magnetic stirrer- UV lamp- Rotary evaporator- Ice machine- Infrared- <sup>1</sup>HNMR- Mass Spectrometer- Vacuum pump
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- **Head of Department: Prof. Dr. Eatedal H. Abd El-aal**

<b>PhD Thesis (Pharmaceutical Organic Chemistry)</b>				
	<b>NARS</b>	<b>Program ILOs</b>	<b>Thesis ILOs</b>	<b>Thesis content</b>
<b>Knowledge and Understanding</b>	2.1.1- Fundamental and in-depth knowledge and basic theories in the field of specialty and the closely related areas of pharmaceutical sciences.	A.1- Demonstrate in-depth knowledge and understanding of application of named reactions in pharmaceutical organic synthesis.	Illustrate fundamentals and advanced knowledge in the field of Pharmaceutical organic chemistry that help to better understand the subject understudy.	<ul style="list-style-type: none"> <li>• Collect all available information about this subject by all possible means.</li> </ul>
	2.1.2- Fundamentals, methods, techniques, tools and ethics of scientific research.	A.2-Deal with all fundamentals, methods, techniques, tools and ethics of scientific research.	Determine methods, tools and techniques used during work.	<ul style="list-style-type: none"> <li>• Increase the awareness of the recent chemical techniques that will be used during practical work and determined by the protocol.               <ul style="list-style-type: none"> <li>• Identify different practical techniques and methods to assess chemical reactions related to the subject under study.</li> </ul> </li> </ul>

2.1.3- The ethical and legal principles in pharmacy and academic practices.	A.3-Be aware with the legal authorities for professional practices in pharmacy and academic practices .	Carry out professional duties in accordance with legal and ethical guidelines.	<ul style="list-style-type: none"> <li>• Apply ethical recommendations in all aspects of scientific research e.g. citation, publication.....</li> <li>• Understand any legal aspects related to the thesis work especially those related to dealing with chemicals.</li> </ul>
2.1.4- The principles and bases of quality assurance in professional practice in the field of specialization.	A.4-Determine the bases of quality assurance in synthetic pharmaceutical organic chemistry.	Define and apply quality bases during practical work.	<ul style="list-style-type: none"> <li>• Identify different practical techniques and methods to assess chemical reactions related to the subject understudy.</li> </ul>
2.1.5- All relevant knowledge concerning the impact of professional practice on society and environment and the ways of their conservation and development.	A.5- Display awareness of all knowledge in both scientific and social community.	Describe the purpose of the research work and its impact on the community and human health.	<ul style="list-style-type: none"> <li>• Suggest the possible points/problems of research that the candidate can work on in the frame of the aim of work and choose proper point related to the problems of the community and surrounding environment.</li> </ul>

<b>Intellectual Skills</b>	2.2.1- Analyze, evaluate the data in his / her specified area, and utilize them in logical inference processes (induction/deduction).	B.1- Analyze, evaluate information in the field of synthesis of pharmaceuticals.	Analyze and interpret the experimental data in a suitable form to utilize them properly.	<ul style="list-style-type: none"> <li>• Select some compounds for their pharmacological or microbiological activities.</li> <li>• Interpret the biological results.</li> <li>• Perform statistical analysis and biological correlation for the results.</li> <li>• Present and describe the results graphically.</li> </ul>
	2.2.2- Propose solutions to specified problems in the light of the available data (information).	B.2- Investigate accurately the practical results and correlate them with the theoretical background to overcome emerging difficulties in the research process.	Propose a solution to the point under study depending on available data.	<ul style="list-style-type: none"> <li>• Integrate different knowledge required to solve suggested problem.</li> <li>• Apply spectroscopic analysis for the new expected compounds (IR, <sup>1</sup>HNMR, Mass and elemental analysis).</li> <li>• Predict synthetic pathways and mechanisms.</li> <li>• Use all possible means to prove target compounds.</li> </ul>

2.2.3- Conduct research studies that add to the current knowledge.	B.3- Construct an outstanding research study in the field of synthesis of pharmaceutical important compounds.	Carry out the research to add to the area of study.	<ul style="list-style-type: none"> <li>• Suggest the possible points/problems of research that the candidate can work on in the frame of the aim of work and choose proper point related to the problems of the community and surrounding environment.</li> <li>• Design the protocol including the steps of work following the suitable timetable.</li> </ul>
2.2.4- Formulate scientific papers.	B.4- Collect all practical and theoretical data to design scientific paper.	Develop writing skills such as clarity and presenting results to formulate scientific papers.	<ul style="list-style-type: none"> <li>• Write scientific reports on the obtained results with conclusive significance.</li> </ul>
2.2.5- Assess hazards and risks in professional practice in his / her area of specialization.	B.5- Manage risks during dealing with chemical reagents.	Manage risks during dealing with chemical reagents.	<ul style="list-style-type: none"> <li>• Evaluate and manage chemical hazards throughout the whole practical work.</li> </ul>

	2.2.6- Plan to improve performance in the pharmaceutical area of interest.	B.6- Improve a laboratory schemes for an advanced organic chemistry issue.	Improve the performance during the practical work.	<ul style="list-style-type: none"> <li>• Design the protocol including the steps of work following the suitable timetable.</li> <li>Suggest possible recommendations based on the outcome of the thesis and decide future plans.</li> </ul>
	2.2.7- Take professional decisions and bears responsibility in wide array of pharmaceutical fields.	B.7- Take professional and scientific decisions regarding emerging situations and needs in the field of pharmaceutical synthesis.	Make decisions related to recent and future studies.	<ul style="list-style-type: none"> <li>•Suggest the possible points/problems of research that the candidate can work on in the frame of the aim of work and choose proper point related to the problems of the community and surrounding environment.</li> <li>-Suggest possible recommendations based on the outcome of the thesis and decide future plans.</li> <li>- Use all possible means to prove target compounds.</li> </ul>
	2.2.8- Be creative and innovative.	B.8- Demonstrate creativity and innovation in the field of pharmaceutical organic chemistry.	Be creative, innovative and original in one's approach to research.	<ul style="list-style-type: none"> <li>• Modify methods and experiments used during practical work.</li> </ul>

	2.2.9- Manage discussions and arguments based on evidence and logic.	B.9- Discuss by theoretical evidences the whole work results.	Discuss by theoretical evidences the whole work results.	<ul style="list-style-type: none"> <li>• Communicate with supervisors to discuss results.</li> <li>• Present the results periodically in seminars.</li> </ul>
<b>Professional and Practical Skills</b>	2.3.1- Mastery of basic and modern professional skills in the area of specialization.	C.1- Perform Professionally high laboratory techniques for synthesis and purification of the target pharmaceuticals.	Perform practical experiments related to the point understudy.	<ul style="list-style-type: none"> <li>• Identify different practical techniques and methods to assess chemical reactions related to the subject under study.</li> <li>• Modify methods and experiments used during practical work.</li> <li>• Apply spectroscopic analysis for the new expected compounds (IR, <sup>1</sup>HNMR, Mass and elemental analysis).</li> <li>• Predict synthetic pathways and mechanisms.</li> <li>• Use all possible means to prove target compounds.</li> </ul>



	2.3.2- Write and critically evaluate professional reports.	C.2- Estimate all data and write professional reports.	Report the work in a written report.	<ul style="list-style-type: none"> <li>• Write scientific reports on the obtained results with conclusive significance.</li> <li>• Summarize the thesis in an understandable Arabic language for non professionals.</li> <li>• Write references in the required form (Thesis, Paper.....).</li> </ul>
	2.3.3- Evaluate and develop methods and tools existing in the area of specialization.	C.3- Select appropriate methods and tools to support goals.	Select appropriate methods and tools to support goals.	<ul style="list-style-type: none"> <li>• Identify different practical techniques and methods to assess chemical reactions related to the subject under study.</li> <li>• Modify methods and experiments used during practical work.</li> </ul>

	2.3.4- Properly use technological means in a better professional practice.	C.4- Use the most recent techniques to improve performance.	Consider developments in technology and how to use to enhance learning.	<ul style="list-style-type: none"> <li>• Collect all available information about this subject by all possible means.</li> <li>• Use internet, journals, books and others thesis to get previous and recent information about the subject understudy.</li> <li>• Present the results periodically in seminars</li> <li>• Demonstrate the thesis in a final power point presentation.</li> </ul>
	2.3.5- Plan to improve professional practices and to improve the performance of other scholars.	C.5- Work to enhance professional practices and performance.	Improve the performance during the practical work.	<ul style="list-style-type: none"> <li>• Modify methods and experiments used during practical work.</li> <li>• Design the protocol including the steps of work following the suitable timetable.</li> <li>- Suggest possible recommendations based on the outcome of the thesis and decide future plans.</li> </ul>
<b>GTS</b>	2.4.1- Effective communication in its different forms.	D.1- Communicate effectively with colleagues and a wider audience in a variety of media.	Communicate effectively in different forms.	<ul style="list-style-type: none"> <li>• Communicate with supervisors to discuss results.</li> <li>• Present the results periodically in seminars.</li> </ul>

2.4.2- Efficiently use the information technologies (IT) in improving the professional practices.	D.2- Improve professional practices using the information technology.	Be competent in the use of computers for data analysis, word-processing, and production of thesis-quality graphics.	<ul style="list-style-type: none"> <li>• Use internet, journals, books and others thesis to get previous and recent information about the subject understudy.</li> <li>• Perform statistical analysis and biological correlation for the results.</li> <li>• Present and describe the results graphically.</li> </ul>
2.4.3- Help others to learn and evaluate their performance.	D.3- Guide others to learn and evaluate their performance.	Evaluate the performance of others and assist them to develop.	<ul style="list-style-type: none"> <li>• Discuss obtained results in comparison with pervious literatures.</li> </ul>
2.4.4- Self- assessment and continuous learning.	D.4- Capable to self-evaluation and continue to learn independently to develop professionally.	Recognize self-limitations and areas for improvement and seek for continuous learning.	<ul style="list-style-type: none"> <li>• Continuous evaluation to the thesis outcome according to the schedule.</li> <li>• Continue self-learning throughout the experimental work and writing scientific papers.</li> </ul>
2.4.5- Use various sources to get information and knowledge.	D.5- Use computer and internet skills to get information and knowledge.	Gather, summarize, and organize information from different sources.	<ul style="list-style-type: none"> <li>• Use internet, journals, books and others thesis to get previous and recent information about the subject understudy.</li> </ul>

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	2.4.6- Work as a member and lead a team of workers.	D.6- Activate working as a member of a team.	Implement tasks as a member of a team.	<ul style="list-style-type: none"><li>• Work effectively as a member of a team (e.g. Supervisors and various professionals).</li></ul>
	2.4.7- Direct scientific meetings and to manage time effectively.	D.7- Run time successfully to reach goals.	Utilize time effectively to achieve goals.	<ul style="list-style-type: none"><li>• Organize the experimental work according to the designed protocol.</li></ul>