Zagazig University
Faculty of Pharmacy
Pharmaceutical
Organic Chemistry
Department

Program and Course Specifications

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- Coordinators: Prof. Dr. / Aza M. Kadry and Prof. Dr. Said A. H. El-Feky
6- Date of program specification approval: 27/8/ 2018
7- Teaching language: English
8- External Evaluator: Prof. Dr. Manal Kandil
9- Internal Evaluator: Prof. Dr. Eatedal H. Abdel aal

…….

B- Professional Information

1- Program aims:

1.1 To provide the postgraduate master students with a special and advanced education in the field of Pharmaceutical organic chemistry.

1.2- To enable them to gain the skills and attributes required for the responsible practice of Organic chemistry experiments.

Consistency of the program aims with the mission of Faculty of Pharmacy:

The faculty of Pharmacy, Zagazig University aims to provide the local and regional community with highly qualified, multidisciplinary and professional pharmacists with ethical values and able to participate in the development of drug industry and quality assurance as well as contribute to a distinguished health service to the society. This is achieved through developing and upgrading the academic programs, teaching and learning methods, supporting various student activities, developing the abilities of the staff members, their assistants and administrative members, enhancing the oriented applied and scientific research and providing the continuous pharmaceutical education.

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 a 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 of 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 the results in the form of a thesis and scientific papers.
C.3 - Choose and implement perfected 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 - Persuit 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:

The faculty is committed to the Academic References Standards for postgraduate studies (March 2009).

Matrix: Comparison between Master degree program ILOs and the Academic Reference Standards, 2009.

	ARS (2009)	Program ILOs
Knowledge and Understanding	2.1.1 - Theories and fundamentals related to the field of learning as well as in related areas.	A1. 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 authoriti s 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 adv nced organic chemistry.
Intellectual Skills	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.

	ARS (2009)	Program ILOs
	2.2.4 - Conduct research and write a 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.
Professional and Practical Skills	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.
General and Transferable Skills	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 - Persuit self estimation in advanced organic chemistry for personal learning needs.

	ARS (2009)	Program ILOs
	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:

- The Masters program can be completed in 3-5 years.
- The Faculty of pharmacy implements the credit hour system.
- Each academic year consists of 2 semesters
- Minimum credit hours that can be registered each semester: 8 hours
- Maximum credit hours that can be registered each semester: 12 hours
- The program is structured as:

1- Courses: General (1 year) and Special

No. of credit hours for program courses:

General: 20 credit hours (Compulsory: 12, Elective: (2x4) 8)

Special: (3courses x4 hours) 12 credit hours

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 oral) a research proposal and write a thesis.

3- General University Requirements: 10 credit hours including:

a- TOEFL (400 units)

b- Computer course

c- Study plan:

Course Code	Course Titl	Credit hours	Program ILOs Covered	Final exam duration
	General Courses:			
M101	Advanced instrumental analysis and chromatography I	4	A1, A2, B1,D4	4 hours
M106	Physical chemistry	4	A1, A2, B1, B2 D1, D2, D3	4 hours
M109	Drug design	4	A1,A2,A3, B1, D1	4 hours
ME2	**Elective course A** Drug stability	4	A1, A2, A3, B1, B2, D1, D2	4 hours
ME3	**Elective Course B** Good practice for analysis of drugs and quality control	4	A1, A2, A3,B1,B2, D1&D2	4 hours
	Special Courses:			
Osp1	Advanced Organic Chemistry: Structure and Mechanism	4	A1, A2, A3, B1, B2, B3, D2, D4, D6, D8	4 hours
Osp2	Advanced Organic Chemistry: Reactions and Synthesis	4	A1, A2, A3, A4, A5, A6, B1, B2, B3 , B4,D2, D4, D6, D7 ,D8.	4 hours
Osp3	Advanced Heterocyclic Organic Chemistry	4	A1, A2, A3, A4, B1, B2 ,B3, D2, D4, D6, D7,D8.	4 hours

	Thesis	30	A1, A2, A4, A5, A6,A7, A8, A9, B1, B2, B3, B4, B5, B6, B7, C1, C2, C3,C4, C5, D1, D2, D3, D4, D5, D6	

d. **Learning Outcomes in Domains of Teaching Strategies & Assessment Methods:**

ILOs	Teaching method	Assessment method
Knowledge and Understanding Intellectual Skills	Lectures Reports Self learning	Written and oral Exam
Professional and practical Skill	Case study Problem solving Thesis	Case discussion Rubric
Intellectual Skills General and Transferable Skills	Group presentation Structured Assignment Thesis	Oral Exam Rubric

5-Program admission requirements:

General Admission Conditions

- The Applicant should finish or being permanently or temporarily exempted from the military service and temporary exemption should be valid for at least one year from the date of the beginning of the study. (Exceptions apply, for demonstrators and assistant lecturers).
- The applicant admission to the M.Sc. program should be no later than ten years from the time of graduation.
- Acquisition of an approval from the Faculty Council following an approval of the concerned Departmental Board as well as

Graduate Studies and Research Committee recommendation within a maximum of one month for any conditions stated by the concerned Departmental Board.

Admission Conditions for M.Sc. Degree

In addition to the general admission conditions stated before, applicants are admitted to M.Sc. Degree upon fulfillment of the following:

The applicants should be holders of Bachelor in Pharmaceutical Sciences from any Faculty of Pharmacy with a general grade at least good (cancelled by a decision of the university council) affiliated to the Egyptian Universities or an equivalent degree granted by any institute recognized by the Supreme Council of Universities.

The Faculty Council is allowed, with the consent of the concerned Departmental Board as well as Graduate Studies and Research Committee, to accept the student for registration of M.Sc. Degree if he has got a diploma from one of the Egyptian Universities in one of the pharmaceutical sciences fields, Faculties, or Institutes that are recognized by the Supreme Council of Universities with a general grade of Good regardless his grades in bachelor degree.

Students should fulfill all the admission requirements stated by the concerned Departmental Board (ICDL certificate, local TOEFL certificate with a grade at least 400).

Admission has to be done within the period announced by the university.

The candidate thesis discussion isn't before one calendar year from research point registration.

Regulations to complete the program:

The Faculty Council, in compliance with the concerned Departmental Board as well as Graduate Studies and Research Committee recommendation awards the M.Sc. Degree upon fulfillment of the following requirements:

- Carrying out a deep research in the area of specialization for at least one or two calendar years and at most three years from the time of registration.
- The student has to succeed in all course examinations.
- Acceptance of the research thesis by the Jury Committee, according to statement 104 of universities regulating law.

Cancellation of Registration

The Faculty Board is allowed to cancel registration for M. Sc. programs in the following circumstances

- Student's failure to pass the course examinations for two times.
- Student's nonattendance or unsatisfactory progress (at least two annual reports) in research work being reported by the advisors and chief supervisor to the Departmental Board and forwarded to the Graduate Studies and Research Committee recommendation for approval of cancellation.
- Dissertation refusal by the Jury Committee.

The incapability of the student to graduate by the deadlines indicated

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%
F	1	< 60%

8-Failure in Courses:

Students who fail to get 60% (1 point). In this case, students can register the course again and their grades are those obtained by repeating the course with maximum GPA being 3

9-Methods of program evaluation

Evaluator	Tool
1- Candidates	(Questionnaires)
2-Stakeholders	(Questionnaires for staff members participating in ıching)
3-External reviewer	
4- Internal reviewer	Prof. Dr. Eatedal H. Abdel Aal
4-Others	Faculty board

Program coordinator: Prof. Dr/ Aza M. Kadry & Prof. Dr. Said A. H. El-Feky

Head of Department: Prof. Dr./ Hanan Abdel Razik

تم اعتماد التوصيف بمجلس الكلية بتاريخ 2018

Courses offered by other departments

Advanced Instrumental Analysis & chromatography I

Course specification of Advanced Instrumental Analysis & chromatography I

Course specifications:

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

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
- Describe new aspects 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

Knowledge and Understanding	
a1	Illustrate theories for separation of different components in combined therapy and their determination quantitatively using different instrumental techniques.
a2	State medicinal and pharmaceutical applications of spectroscopy , HPLC and GC
Intellectual skills	
b1	Analyze & interpret qualitative & quantitative data obtained from instrumental analysis
General and Transferable skills	
d4	Write reports and present it.

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

Week number	Lecture contents (4hrs/week)
1	Advanced Ultra-violet spectroscopy
2	New aspects in vibrational spectroscopy (IR spectroscopy)
3	Application of Nuclear magnetic resonance (NMR)
4	Application of Mass spectrometry(MS)
5	Medicinal application of spectroscopy in diagnosis of diseases
6	Raman spectroscopy.
7	Advanced HPLC. **Activity (Reports)**
8	HPLC & its medicinal and pharmaceutical application
9	High performance thin layer chromatography

	(HPTLC).
10	Advanced Gas chromatography.
11	GC & its medicinal and pharmaceutical application
12	New aspects of Supercritical fluid chromatography (SFC) and ion exchange chromatography (IEC).
13	Capillary electrophoresis(CE)
14	Analytical application of dimeric and polymeric molecules. **Activity (Reports)**
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:

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

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %

• Oral exam	15	15 %
TOTAL	**100**	**100%**

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

www.sciencedirect.com

Facilities required for teaching and learning:

1. **For lectures:** White boards, computer and data show.

- **Head of Department:**
- **Date:** تم اعتماد التوصيف بمجلس القسم بتاريخ

Matrix I of Advanced Instrumental Analysis & chromatography I

Course Contents		ILOs of Advanced Instrumental Analysis & chromatography I course			
		Knowledge and understanding		Intellectual skills	General and Transferable skills
		a1	**a2**	**b1**	**d4**
1	Advanced Ultra-violet spectroscopy	x	x	X	
2	New aspects of Vibrational spectroscopy (IR spectroscopy)	x	x	X	
3	Application of Nuclear magnetic resonance (NMR)	x	x	X	
4	Application of Mass spectrometry(MS)	x	x	X	
5	Medicinal application of spectroscopy in diagnosis of diseases		x	X	
6	Raman spectroscopy.	x			
7	Advanced HPLC. **Activity (Reports)**	x		X	X
8	HPLC & its medicinal and pharmaceutical application		x		
9	High performance thin layer chromatography (HPTLC)	x		X	
10	Advanced Gas chromatography	x			
11	GC & its medicinal and pharmaceutical application		x	X	
12	New aspects of Supercritical fluid chromatography (SFC) and ion exchange chromatography (IEC)	x	x		
13	Capillary electrophoresis(CE)	x	x		
14	Analytical application of dimeric and polymeric molecules. **Activity (Reports)**		x	X	x
15	Revision and open discussion	x	x	X	

Matrix II of Advanced Instrumental Analysis & chromatography I

ARS		Program ILOs	Course ILOs	Course contents	Sources	Teaching and learning methods		Method of assessment		
						Lecture	Self learning	Written exam	Oral exam	Activities
2.1	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.2- Illustrate theories of Qualitative and Quantitative estimation of different formulations	a1	Advanced Ultra-violet spectroscopy New aspects of Vibrational spectroscopy (IR spectroscopy) Application of Nuclear magnetic resonance (NMR) Application of Mass spectrometry(MS) Raman spectroscopy Advanced HPLC High performance liquid chromatography HPTLC Advanced Gas chromatography New aspects of Supercritical fluid chromatography (SFC) Capillary electrophoresis(CE)	Textbooks, Scientific papers and self-learning	X	x	X	X	

	2.1.2- Mutual influence between professional practice and its impact on the environment.	A.4- Demonstrate applications of Quality control and Quality assurance that serves the community and patients.	a2	Advanced Ultra-violet spectroscopy New aspects of Vibrational spectroscopy (IR spectroscopy) Application of Nuclear magnetic resonance (NMR) Application of Mass spectrometry(MS) Medicinal application of spectroscopy in diagnosis of diseases Advanced HPLC & its medicinal and pharmaceutical application Advanced GC & its medicinal and pharmaceutical application New aspects of Supercritical fluid chromatography (SFC) Capillary electrophoresis(CE) Analytical application of dimeric and polymeric molecules.	Textbooks, Scientific papers and self-learning	X	x	x	X	

2.2	2.2.1- Analyze and evaluate information in the field of specialization and analogies to solve problems	B.1- Analyze and interpret data obtained from Instrumental analysis of different drugs in a specific and suitable form.	b1	Advanced Ultra-violet spectroscopy New aspects of Vibrational spectroscopy (IR spectroscopy) Application of Nuclear magnetic resonance (NMR) Application of Mass spectrometry(MS) Medicinal application of spectroscopy in diagnosis of diseases Advanced HPLC & its medicinal and pharmaceutical application Advanced GC & its medicinal and pharmaceutical application	Textbooks, Scientific papers and self learning	X	x	X	X	
2.4	2.4.4- Use variable sources to get information and knowledge.	D.4- Find information from a range of sources in the field of Drug synthesis and analysis and recent topics in medicinal chemistry.	d1	Activity (Reports)	Internet Textbooks		x			x

Physical Chemistry

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: Analytical Chemistry.
- Department offering the course: Analytical Chemistry.
- Date of specification approval:

1- Basic information:

Title: **Physical Chemistry** Code: M106

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 should be able to outline the principles of kinetics, catalysis, solutions and photochemistry and describe theories of reaction rate, types of chemical reaction criteria of catalysis.

3. Intended learning outcomes of Physical Chemistry:

A- Knowledge and Understanding	
a1	Outline the principles of kinetics, catalysis, solutions and photochemistry
a2	Demonstrate the behavior and laws governing, photochemistry, solutions and chemical reactions and their applications.
B- Intellectual skills	
b_1	Describe units of measurements and calculations with chemical formulas and equations.
b_2	Integrate the knowledge and information obtained from physical chemistry principles in determining rates of the reaction.
D- General and Transferable skills	
d_1	Acquire Computer skills like preparing presentations and collecting information through different data-bases.
d_2	Work effectively as a member of team
d_3	Improve scientific brain storming capabilities of team members

4. Course Contents of Physical Chemistry:

Week number	Contents
1	• Introduction of kinetics and rate of reactions
2	• Molecular and order of reaction.
3	• Parallel and consecutive reactions.
4	• Methods used for determination of the order of reactions
5	• Theories of reaction rates and chain reaction
6	• Criteria of catalysis.
7	• Homogenous and enzyme catalysis
8	• Heterogeneous catalysis / **Activity**

9	• Nature of electrolytes in solution.
10	• Photochemistry and properties of electromagnetic radiations.
11	• Laws of photochemical process, quantum yield and chain reaction.
12	• Solutions: • Principles and concentration and solubility.
13	• Factors affecting solubility • Solute-solvent interaction. • Solubility and temperature. • Effect of pressure on solubility.
14	• Solutions of liquids in liquids • Solutions of solid in liquids (Colligative properties of solutions.)
15	• Open discussion and revision

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion
- Internet based search

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:

Assessment (1): Activity	Week 8
Assessment (2): Written exam	Week 16
Assessment (3): oral exam	Week 16

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

7- References and books:

A-Scientific papers

B- Essential 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/Journal:

Analytical Chemistry

www.sciencedirect.com

www.rsc.org

Facilities required for teaching and learning:

1. **For lectures:** White boards, computer, data show.

- **Course Coordinator: Prof Dr/ Wafaa Hassan**
  Prof Dr/ Mervat Hosny
- **Head of Department: Prof. Dr. Magda El Henawee**

تم اعتماد توصيف المقرر في مجلس القسم بتاريخ

Matrix I of Physical Chemistry								
Course Contents		ILOs						
		Knowledge and understanding		Intellectual skills		General and Transferable skills		
		a1	a2	b1	b2	d_1	d_2	d_3
1	• Introduction of kinetics and rate of reactions	X						
2	• Molecular and order of reaction.			x				
3	• Parallel and consecutive reactions.			x	x			
4	• Methods used for determination of the order of reactions	X						
5	• Theories of reaction rates and chain reaction		X					
6	• Criteria of catalysis.		x					
7	• Homogenous and enzyme catalysis	X						
8	• Heterogeneous catalysis	X				X	X	X
9	• Nature of electrolytes in solution.	X						
10	• Photochemistry and properties of electromagnetic radiations.		x					
11	• Laws of photochemical process, quantum yield and chain reaction.		x					

12	• Solutions: • Principles and concentration and solubility.		**x**					
13	• Factors affecting solubility • Solute-solvent interaction. • Solubility and temperature. • Effect of pressure on solubility.		**x**					
14	• Solutions of liquids in liquids • Solutions of solid in liquids (Colligative properties of solutions.)		**x**					
15	• Open discussion and revision	**X**				**x**	**x**	**x**

Matrix II of Physical Chemistry

ARS		Program ILOs	Course ILOs	Course contents	Sources	Teaching and learning methods		Method of assessment		
						Lecture	Self-learning	Written exam	Oral Exam	Activity
2.1	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.1- Illustrate the basics of analytical chemistry and related subjects including: instrumental analysis, spectrophotometry, electrochemistry, physical chemistry and chemical kinetics.	a1	• Introduction of kinetics and rate of reactions. • Methods used for determination of the order of reactions • Homogenous and enzyme catalysis • Heterogeneous catalysis • Nature of electrolytes in solution.	Textbooks, Scientific papers and self learning	x	X	x	x	
	2.1.3- Scientific developments in the area of specialization .	A.4- Describe the most advanced Instrumental techniques in analytical chemistry and their applications. A.6- Figure out drug stability features and kinetics chemistry.	a2	• Theories of reaction rates and chain reaction • Criteria of catalysis. Photochemistry and properties of electromagnetic radiations. • Laws of photochemical process, quantum yield and chain reaction. Solutions: • Principles and concentration and solubility. Factors affecting						

				solubility • Solute-solvent interaction. • Solubility and temperature. • Effect of pressure on solubility. • Solutions of liquids in liquids • Solutions of solid in liquids (Colligative properties of solutions.)						
2.2	2.2.1- Analyze and evaluate information in the field of specialization and analogies to solve problems	B.1- Analyze and interpret both quantitative and qualitative data obtained from analytical chemistry research in a specific and suitable form.	b1	Units of measurements and dimensional analysis---Calculations with chemical formulas and equations.	Textbooks, Scientific papers and self-learning	x	X	x	x	
	2.2.3- Correlate and integrate different pharmaceutical knowledge to solve professional	B.3- Integrate the gained knowledge of analytical chemistry, for analysis analytes of complex nature.	b2	Calculations with chemical formulas and equations.	Textbooks, Scientific papers and self-learning	x	x	x	x	

	problems.									
2.4	**2.4.2- Effectively use information technology in professional practices**	D.2- Acquire computer skills such as internet, word processing, chemometric and kinetic softwares.	d1	Activity						X
	2.4.6- Work in a team and lead teams carrying out various professional tasks.	D.6- Work effectively as a team member.	d2	Activity						x
	2.4.5- Set criteria and parameters to evaluate the performance of others	D.5- Set rules for judging others chemists performance in the team.	d3	Activity						x

Drug Design

Course specification of Drug Design

Course specifications:

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

1- Basic information:

Title: **Drug Design** Code: M109

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

- Outline principles of drug design, docking
- Utilize combinatorial chemistry in the synthesis of drugs.

3. Intended learning outcomes (ILOs) of Drug Design

Knowledge and Understanding	
a1	Outline principles of drug design and combinatorial chemistry.
a2	Describe applications of drug design and QSAR.
a3	Illustrate clearly the up-to date information & methods in drug design and docking.
Intellectual skills	
b1	Solve or propose solutions to specified problems in drug design
General and Transferable skills	
d1	Write reports and present it.

4. Course Content of Drug Design

Week number	Lecture contents (4hrs/week)
1	Principles of drug design
2	Combinatorial chemistry (combinatorial and parallel synthesis in medicinal chemistry projects)
3	Combinatorial chemistry (solid phase techniques)
4	QSAR (hydrophobicity, electronic effects)
5	QSAR(steric factors, other physicochemical parameters)
6	**Activity(Reports)**
7	Drug design and relationship of functional groups to biological activity (hydrophilic/ hydrophobic properties)
8	Drug design and relationship of functional groups to biological activity (resistance to chemical and enzymatic degradation)
9	Relationship between molecular structure and biological activity
10	Docking (Introduction)
11	Docking (procedures)
12	**Activity (Reports)**
13	Applications of drug design (self destruct drugs, peptidomimetics)
14	Applications of drug design (targeting drugs)
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:

Assessment (1): Activity	Week 6-12
Assessment (2): Written exam	Week 16
Assessment (3): oral exam	Week 16

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

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

www.sciencedirect.com

Facilities required for teaching and learning:

For lectures: White boards, computers and data show.

Course Coordinators:

- **Head of Department:**
- **Date** تم اعتماد التوصيف بالقسم بتاريخ

Matrix I of Drug Design

	Course Contents	ILOs of Drug Design course				
		Knowledge and understanding			Intellectual skills	General and Transferable skills
		a1	**a2**	**a3**	**b1**	**d1**
1	Principles of drug design	x				
2	Combinatorial chemistry (combinatorial and parallel synthesis in medicinal chemistry projects)	x				
3	Combinatorial chemistry (solid phase techniques)	x				
4	QSAR (hydrophobicity, electronic effects)		x			
5	QSAR(steric factors, other physicochemical parameters)		x			
6	**Activity(Reports)**					x
7	Drug design and relationship of functional groups to biological activity (hydrophilic/ hydrophobic properties)		x	x		
8	Drug design and relationship of functional groups to biological activity (resistance to chemical and enzymatic degradation)		x	x		
9	Relationship between molecular structure and biological activity		x	x		
10	Docking (Introduction)			x		
11	Docking (procedures)			x		
12	**Activity(Reports)**					x
13	Applications of drug design (self destruct drugs, peptidomimetics)				x	
14	Applications of drug design (targeting drugs)				**x**	
15	Revision & Open Discussion	x	x	x	x	x

Matrix II of Drug Design

ARS		Program ILOs	Course ILOs	Course contents	Sources	Teaching and learning methods		Methods of assessment		
						Lecture	Self learning	Written exam	Oral exam	Activities
2.1	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.1- Outline principles of drug design, docking and combinatorial chemistry.	a1	Principles of drug design. Combinatorial chemistry	Textbooks, Scientific papers and self learning	x	x	x	x	
	2.1.2- Mutual influence between professional practice and its impact on the environment.	A.3- Describe applications of drug design and QSAR	a2	QSAR Drug design and relationship of functional groups to biological activity. Relatioship between molecular structure and biological activity.	Textbooks, Scientific papers and self learning	x	x	x	x	
	2.1.3- Scientific developments in the area of specialization.	A.5- Record the recent advances in the field of instrumental analysis, CADD, and advanced medicinal chemistry.	a3	Drug design and relationship of functional groups to biological activity. Relationship between molecular structure and biological activity. Docking Activity	Textbooks, Scientific papers and self learning	x	x	x	x	

2.2	2.2.3-Correlate and integrate different pharmaceutical knowledge to solve professional problems.	B.3- Apply learnt knowledge to solve professional problems associated with drug design and synthesis.	b1	Applications of drug design.	Textbooks, Scientific papers and self learning	x	x	x	x	
2.4	2.4.4- Use variable sources to get information and knowledge.	D.4- Find information from a range of sources in the field of Drug synthesis and analysis and recent topics in medicinal chemistry.	d1	Activity (Reports)	Internet Textbooks		x			x

Good practice for analysis of drugs and quality control

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

Course specifications:

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

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

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

4. Course Content :

Week number	Lecture contents (4hrs/week)
1	Validation parameters in analysis
2	Application of quantitative analysis for different drugs.
3	Quality control and how to minimize the synthesis errors.
4	Quality assurance and basic requirement.
5	Applications of Spectrophotometric analysis for dosage forms **Activity**
6	H^{1},C^{13},N^{15},F^{19}- NMR
7	Advanced techniques in mass spectroscopy
8	Atomic absorption
9	Fluorimetric analysis

10	Radioimmune Assay
11	Electrophoresis
12	Advanced GC-MS chemistry **Activity**
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:

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

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• oral exam	15	15 %
TOTAL	**100**	**100%**

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

www.sciencedirect.com

Facilities required for teaching and learning:

For lectures: White boards, data show.

- **Course Coordinators:**
- **Head of Department**
- **Date** تم اعتماد توصيف المقرر بمجلس القسم بتاريخ

Matrix I of Good practice for analysis of drugs and quality control

Course Contents		ILOs of Quality in Instrumental Analysis and Quality Control course						
		Knowledge and understanding			Intellectual skills		General and Transferable skills	
		a1	a2	a 3	b1	b 2	d1	d 2
1	Validation parameters in analysis	x		x				
2	Application of quantitative analysis for different drugs.	x	x	x				
3	Quality control and how to minimize the systemic errors.	x		x	x			
4	Quality assurance and basic requirements of GMP	x		x				
5	Application of Spectrophotometric analysis(UV-VIS-IR) **Activity**		x		x	x	x	X
6	H^{1},C^{13},N^{15},F^{19}- NMR	x	x			x		
7	Advanced techniques in mass spectroscopy		x			x		
8	Atomic absorption			x		x		
9	Fluorimetric analysis		x			x		
10	Radioimmune Assay		x					
11	Electrophoresis		x					
12	Advanced GS-MS chemistry. **Activity**	x		x			x	X
13	Spectrodenistometric (TLC scanner)	x		x	x			
14	Forensic chemistry.	x	x					

Matrix II of Good practice for analysis of drugs and quality control

ARS		Program ILOs	Course ILOs	Course contents	Sources	Teaching and learning methods		Method of assessment		
						Lecture	Self learning	Written exam	Oral exam	Activities
2.1	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.2- Illustrate theories of Qualitative and Quantitative estimation of different formulations.	a1	Validation parameters in analysis Application of quantitative analysis for different drugs H^{1},C^{13},N^{15},F^{19}- NMR Forensic chemistry Spectrodenistometric (TLC scanner) Advanced GC-MS Techniques	Textbooks, Scientific papers and self learning	X	x	X	X	
	2.1.3- Scientific developments in the area of specialization	A.5- Record the recent advances in the field of Instrumental analysis, CADD, and advanced medicinal chemistry	a2	Application of quantitative analysis for different drugs Applications of Spectrophotometric analysis for dosage forms H1,C13,N15,F19 NMR Advanced techniques in mass spectroscopy Fluorimetric analysis Radioimmune Assay Electrophoresis Forensic chemistry	Textbooks, Scientific papers and self learning	X	x	X	X	

	2.1.5- Principles and the basics of quality in professional practice in the area of specialization.	A.7- Identify the principles to ensure quality and Validation of analysis results.	a3	Spectrodenistometric (TLC scanner) Atomic absorption GC-MS Techniques Validation parameters in analysis Application of quantitative analysis Quality control and how to minimize systemic errors. Quality assurance and basic requirements of GMP	Textbooks, Scientific papers and self learning	X	x	X	X	
2.2	2.2.1- Analyze and evaluate information in the field of specialization and analogies to solve problems	B.1- Analyze and interpret data obtained from Instrumental analysis of different drugs in a specific and suitable form.	b1	Quality control and how to minimize systemic error Applications of Spectrophotometric analysis for dosage forms Spectrodenistometric (TLC scanner)	Textbooks, Scientific papers and self learning	X	x	X	X	
	2.2.5- Evaluate and manage risks and potential hazards in professional practices in the area of specialization	B.6-Evaluate risks in experiments and techniques used during handling chemicals and deal with them effectively.	b2	Applications of Spectrophotometric analysis for dosage forms Advanced techniques in mass spectroscopy Atomic absorption Fluorimetric analysis H^1,C^{13},N^{15},F^{19}- NMR	Textbooks, Scientific papers and self learning	X	x	X	X	

2.4	2.4.2- Effectively use information technology in professional practices	D.2- Demonstrate appropriate information technology skills especially in the areas of word processing, internet communication, information retrieval and online literature searching	d1	Activity (Reports)	Internet Textbooks		x			x
	2.4.4- Use variable sources to get information and knowledge.	D.4- Find information from a range of sources in the field of Drug synthesis and analysis and recent topics in medicinal chemistry.	d2	Activity (Reports)	Internet Textbooks		x			X

Drug Stability

Course specification of Drug stability

Course specifications:

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

1- Basic information:

Title: **Drug stability** Code: ME2
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 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 ability to predict the degradation pathways of a drug design a stabilization protocol and predict a product shelf-life and discuss regulations and methodologies for drug stability program.

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

Knowledge and Understanding	
a1	Illustrate the principles drug stability
a2	Describe the regulations for drug stability program
a3	Describe the methodologies for drug stability program
Intellectual skills	
b1	Suggest suitable stability methods for drugs in the various dosage forms.
b2	Design in a self-directed and original research investigations on drug stability in dosage forms from degradation pathways
General and Transferable skills	
d1	Use computer skills to present information
d2	Collect information from a variety of sources

4. Course Content of Drug stability (Master degree):

Week number	Lecture content (4 hr/w)
1	• Drug stability (Overview – importance)
2	• Stability regulations (overview)
3	• Critical regulatory requirements for a stability program
4	• Global stability practices
5	• Understanding and predicting pharmaceutical product shelf life
6	• Stability methodologies (overview)
7	• Development of stability indicating methods • **(Presentation)**
8	• Overview of USP-NF requirements for stability
9	• Non chromatographic methods for stability program
10	• Vibrational spectroscopic methods for quantitative analysis
11	• Evaluation of stability data
12	• Qualification, calibration and maintenance of stability chambers
13	• **Stability operation practices**
14	• Stability studies in biologics
15	• Open discussion • **(Final Presentation)**

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion
- Problem solving

6- Student Assessment methods:

Written exams to assess: a1, a2, a3, b1, b2
Oral exam to assess: a1, a2, a3, b1, b2
Activities to assess: d1, d2

Assessment schedule:

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

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

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:

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

2- Extended Stability for Parenteral Drugs, 5th Edition (Extended Stability of Parenteral Drugs), Fifth Edition, Caryn Dellamorte Bing R.PH. M.S. FASHP and Anna Nowobilski-Vasilios , American Society of Health-System Pharmacists; (2013)

C- Websites: Pubmed, Sciencedirect, Weilyinterscience

Facilities required for teaching and learning:

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

- **Course Coordinators:**
- **Head of Department:**
- **Date:** تم اعتماد التوصيف بمجلس القسم

Matrix I of Drug Stability								
Course Contents		ILOs of drug stability course						
		Knowledge and understanding			Intellectual skills		Transferable and general skills	
		a1	a2	a3	b1	b2	d1	d2
1	Drug stability (Overview – importance)	X						
2	Stability regulations (overview)		x					
3	Critical regulatory requirements for a stability program		x					
4	Global stability practices		x					
5	Understanding and predicting pharmaceutical product shelf life		x			x		
6	Stability methodologies (overview)			x				
7	Development of stability indicating methods **(Presentation)**			x			x	x
8	Overview of USP-NF requirements for stability			x				
9	Non chromatographic methods for stability program			x	x			
10	Vibrational spectroscopic methods for quantitative analysis			x	x			
11	Evaluation of stability data			x	x			
12	Qualification, calibration and maintenance of stability chambers			x				
13	Stability operation practices			x				
14	Stability studies in biologics			x				
15	Open discussion **(Final Presentation)**	x	x	x	x	x	X	x

Matrix II of Drug stability										
ARS		Program ILOs	Course ILOs	Course contents	Sources	Teaching and learning methods		Method of assessment		
						Lecture	Self-learning	Written exam	Oral Exam	Activity
2.1	2.1.3- Scientific developments in the area of specialization.	A.8- Demonstrate the stability programs for pharmaceutical products and the latest regulations for stability testing and ability to predict the degradation pathways of a drug design a stabilization protocol and predict a product shelf-life.	a1	Drug stability (Overview – importance)	Textbooks, Scientific papers and self-learning	x	xx	x	x	
			a2	Stability regulations (overview) Critical regulatory requirements for a stability program Global stability practices Understanding and predicting pharmaceutical product shelf life	Textbooks, Scientific papers and self-learning	x	x	X	x	
	2.1.5- Principles and the basics of quality in professional practice in the area of specialization.	A.11- Mention the legal aspects for professional practices.	a3	Stability methodologies (overview) Development of stability indicating methods Overview of USP-NF requirements for stability Non chromatographic methods for stability program Vibrational spectroscopic methods for quantitative analysis Evaluation of stability data	Textbooks, Scientific papers and self learning	x	X	X	x	

				Qualification, calibration and maintenance of stability chambers Qualification, calibration and maintenance of stability chambers Stability operation practices Stability studies in biologics						
	2.2.1- Analyze and evaluate information in the field of specialization and analogies to solve problems	B.1- Analyze and interpret quantitative data obtained from pharmaceutical research in a specific and suitable form.	b1	Understanding and predicting pharmaceutical product shelf life	Textbooks, Scientific papers and self-learning	x	x	x	x	
2.2	2.2.2- Solve specified problems in the lack or missing of some information.	B.2- Suggest significant solutions for pharmaceutical results and outcome errors based on a wide academic background.	b2	Non chromatographic methods for stability program Vibrational spectroscopic methods for quantitative analysis Evaluation of stability data	Textbooks, Scientific papers and self-learning	x	x	x	x	
2.4	2.4.2- Effectively use information technology in professional practices	D.2- Acquire computer skills in analyzing results and presenting them.	d1	Activity	Textbooks, Scientific papers and self-learning		x			**X**

	2.4.4- Use variable sources to get information and knowledge.	D.4-Practice how to retrieve information from a variety of sources including libraries, databases and internet.	d2	Activity	Textbooks, Scientific papers and self-learning		x			**x**

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: 2018

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.
- Evaluate and use the current literature in organic chemistry in the field of pharmaceutical industry.

3. Intended learning outcomes (ILOs) of Advanced Organic Chemistry: Structure and Mechanism:

Knowledge and Understanding

a1	Outline the basics of chemical bonding and molecular structure, Stereochemistry, stereoselectivity, stability and photochemistry.
a2	Point out the mechanism of nucleophilic substitution, polar addition, polar elimination, pericyclic reaction, free radical reactions and photochemical reaction.
a3	Explain the criteria of aromaticity and outline its utility.

Intellectual skills

b1	Propose a mechanism for a given reaction.
b2	Determine the number of stereo isomers for a given organic compound.
b3	Find out whether a given cyclic compound is aromatic, non-aromatic or anti-aromatic.

General and Transferable Skills	
d2	Use computer skills to present information
d4	Collect information from a variety of sources
d6	Improve scientific brainstorming capabilities of team members
d8	Show independent learning skills.

4. Course Content of Advanced Organic Chemistry: Structure and Mechanism:

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

12	Concerted pericyclic reaction
13	Free radical reaction
14	Photochemistry
15	Illustrative examples for stability of organic pharmaceuticals/ **Revision and open discussion.**

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion
- Critical thinking

6- Student Assessment methods:

Written exams to assess: a1, a2, a3, b1, b2 and b3
Oral exam assess: a1, a2, a3, b1, b2 and b3
Activity assess: d2, d4, d6, d8

Assessment schedule:

Assessment (1): Activity	Week 10
Assessment (2): Written exam	Week 16
Assessment (3): oral exam	Week 16

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

7- References and books:

A-Scientific papers
B- Essential books:
Advanced organic chemistry- Carry & Sunberg Part I

C-Website : Science direct, Pubmed

Facilities required for teaching and learning:

1. **For lectures:** White boards, computer, data show.

- **Course Coordinators: Prof Dr/ Azza KAdry.**
  Prof. Dr. Said A. H. El-Feky.
- **Head of Department: Prof Dr/ Hanan Abdel Razik**
- **Date: 2018 -8 -27**

Matrix I of Advanced Organic Chemistry: Structure and Mechanism 2017-2018

Week number	Course Contents	Knowledge and understanding			Intellectual skills			General and Transferable Skills			
		a1	a2	a3	b1	b2	b3	d2	d4	d6	d8
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		X		x						
10	**Activity (review article)** / Aromaticity			x			x	x	x	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 / **Revision and open discussion.**	x	x	x	X	x	x	x	x	x	x

Matrix II of Advanced Organic Chemistry: Structure and Mechanism 2017-2018

ARS		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	.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	
			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	
Intellectual Skills			a3	.Aromaticity .Illustrative examples for stability of organic pharmaceuticals	Scientific papers, text books and Internet	x	x	x	x	

	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	
and Transfera	2.4.1- Communicate effectively.	D.1- Contact effectively with professionals.		Activity						X

General and Transferable Skills	2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.			Scientific papers, text books and Internet					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.			Scientific papers, text books and Internet					X
	2.4.7- Manage time effectively.	D.7- Run time successfully to get goals.								X
	2.4.8- Continuous and self learning.	D.8- Get independent learning for research studies.								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: 2018

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.
- Evaluate current literature in organic chemistry.

3. Intended learning outcomes (ILOs) of Advanced Organic Chemistry: Reactions and Synthesis:

Knowledge and Understanding

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

Intellectual skills

b1	Propose a multistep synthetic scheme towards a required target
b2	Recognize the incompatibilties 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

General and Transferable Skills	
d2	Use computer skills to present information
d4	Collect information from a variety of sources
d6	Improve scientific brainstorming capabilities of team members
d7	Run time successfully to get goals.
d8	Show independent learning skills.

4. Course Content of Advanced Organic Chemistry: Reactions and Synthesis:

Week number	Lecture contents (4hrs/week)
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 1and 2 metals
8	Reactions involving transition metals
9	Reactions involving carbocations as reactive intermediates
10	Reactions involving carbenes,and radicals as reactive intermediates
11	**Activity (Problem solving)** /Aromatic substitution reactions
12	Oxidations
13	Retrosynthetic analysis
14	Synthetic equivalence and control of stereochemistry
15	Illustrative examples for multistep synthesis / **Activity (Problem solving)**

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion

6- Student Assessment methods:

- Written exams to assess: a1, a2, a3, a4, a5, a6, b1, b2, b3 and b4
- Oral exam assess: a1, a2, a3, a4, a5, a6, b1, b2, b3 and b4
- Activity assess: d2, d4, d6, d7 and d8.

Assessment schedule:

Assessment (1): Activity	Week 11 and 15
Assessment (2): Written exam	Week 16
Assessment (3): oral exam	Week 16

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

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:** White boards, computer, data show.

- **Course Coordinators: Prof. Dr. Azza Kadry.**
  Prof. Dr. Said A. H. El-Feky.
- **Head of Department: Prof Dr/ Hanan Abdel Razik**
- **Date: 2018 -8 -27**

Matrix I of Advanced Organic Chemistry: Reactions and Synthesis 2018-2019

Week number	Course Contents	Knowledge and understanding						Intellectual skills				Gen Trai Skil				
		a1	a2	a3	a4	a5	a6	b1	b2	b3	b4	d2	d4	d6	d7	d8
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 1and 2 metals				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	**Activity (Problem solving)** /Aromatic substitution reactions					X						x	x	x	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 / **Activity (Problem solving)**			x				x	x		x	x	x	x	x	

Matrix II of Advanced Organic Chemistry: Reactions and Synthesis for 2017-2018										
ARS		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 1and 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	

General and Transferable Skills	2.4.1- Communicate effectively.	D.1- Contact effectively with professionals.		Activity						X
	2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.			Scientific papers, text books and Internet					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.			Scientific papers, text books and Internet					X
	2.4.7- Manage time effectively.	D7- Run time successfully to get goals.								X
	2.4.8- Continuous and self learning.	D8- Get independent learning for research studies.								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: 2018

1- Basic information:

Title: **Advanced Heterocyclic Organic Chemistry**
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:

Knowledge and Understanding

a1	Know the rules of nomenclature and describe structural and spectroscopic properties of heterocycles.
a2	Summarize the ring synthesis of aromatic and non aromatic heterocycles.
a3	Point out the role of heterocycles in biochemistry and medicine.
a4	Discuss various types of reactions with electrophilic, nucleophilic, oxidizing and reducing reagents.

Intellectual skills

b1	Design effective synthetic routes to the desired heterocyclic pharmaceutical targets.
b2	Estimate the reactivity of electron deficient and electron rich heterocycles.
b3	Employ and modify heterocyclic chemistry literature procedures.

General and Transferable Skills	
d2	Use computer skills to present information
d4	Collect information from a variety of sources
d6	Improve scientific brainstorming capabilities of team members
d7	Run time successfully to get goals.
d8	Show independent learning skills.

4. Course Content of Advanced Heterocyclic Organic Chemistry:

Week number	Lecture contents (4hrs/week)
1	Heterocyclic nomenclature
2	Structures and spectroscopic properties of aromatic heterocycles
3	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
10	Benzanellated 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 / **Activty (Report)**

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Presentation

6- Student Assessment methods:

Written exams to assess: a1, a2, a3, a4, b1, b2 and b3
Oral exam assess: : a1, a2, a3, a4, b1, b2 and b3
Activity assess: d2, d4, d6, d7 and d8.

Assessment schedule:

Assessment (1): Activity	Week 15
Assessment (2): Written exam	Week 16
Assessment (3): oral exam	Week 16

Weighting of Assessment:

Assessment method	**Marks**	**Percentage**
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

7- References and books:

A-Scientific papers
B- Essential books:
Heterocycic chemistry.,John A. Joule,Keith Mills,2009
C- Suggested books:
Bioactive heterocycles, R. R. Gupta, 2006 .
Online book: Advances in Heterocyclic Chemistry, Volume 122 ,1st Edition; Eric Scriven and Christopher Ramsden. Academic Press 2017.

D- Websites:
Pubmed, Sciencedirect

Facilities required for teaching and learning:
1. **For lectures:** white boards, computer, data show.

- **Course Coordinators: prof Dr/ Azza Kadry, Prof. Dr. Said El-Feky**
- **Head of Department: Prof Dr/ Hanan Abdel Razik**
- **Date: 2018 -8 -27**

Matrix I of Advanced Heterocyclic Organic Chemistry
2018-2019

Week number	Course Contents	Knowledge and understanding				Intellectual skills								
		a1	a2	a3	a4	b1	b2	b3	d2	d4	d6	d7	d8	
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				X	x	x							
10	Benzanellated 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 / **Activity (report)**			x					x	x	x	X	x	

Matrix II of Advanced Heterocyclic Organic Chemistry for 2018-2019										
ARS		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 combinoterial 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	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	Scientific papers, text books and Internet	x	x	x	X	
			a4	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	

	2.1.3- 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	

General and Transferable Skills	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.		Activity						X
	2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.			Scientific papers, text books and Internet					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.			Scientific papers, text books and Internet					X
	2.4.7- Manage time effectively.	D7- Run time successfully to get goals.								X
	2.4.8- Continuous and self learning.	D8- Get independent learning for research studies.								X

Thesis Specification

Master of Pharmaceutical Organic Chemistry

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:** 2018

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):

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

d4	Use various sources to get information about the subject under study.
d5	Set rules for evaluation and judging others performance.
d6	Work effectively as a member of a team.
d7	Acquire time management skills.
d8	Study independently and plan research studies.

4. Thesis Content:

Steps	Content
1st	• Suggest the possible points/ problems of research that the candidate can work on in the frame of the aim of work and choose a proper point related to the problems of the community and the surrounding environment. • Collect all available information about this subject by all possible means. • Use internet, journals, books and others thesis to get previous and recent information about the subject under study. • Design the protocol, including the steps of work following the suitable timetable. • Increase the awareness of the recent chemical techniques that will be used during practical work and determined by the protocol. • Integrate different knowledge required to solve suggested problem. • Continuous evaluation of the thesis outcome, according to the schedule.
2nd	• Identify different practical techniques and methods to assess chemical reactions related to the subject under study. • Evaluate and manage chemical hazards throughout the whole practical work. • Organize the experimental work according to the designed protocol. • Apply spectroscopic analysis of the new expected compounds (IR, 1HNMR, Mass and elemental analysis). • Predict synthetic pathways and mechanisms. • Use all possible means to prove target compounds.

	• Apply ethical recommendations in all aspects of scientific research e.g. citation, publication……
3rd	• Select some of the compounds for their pharmacological or microbiological activities. • Interpret the biological results. • Perform statistical analysis and biological correlation for the results. • Present and describe the results graphically. • Understand any legal aspects related to the thesis work especially those related to dealing with chemicals.
4th	• Communicate with supervisors to discuss results. • Work effectively as a member of a team (e.g. Supervisors and various professionals). • Present the results periodically in seminars. • Write scientific reports on the obtained results with conclusive significance. • Discuss obtained results in comparison with pervious literatures. • Suggest possible recommendations based on the outcome of the thesis and decide future plans. • Present the thesis in a written form. • Summarize the thesis in an understandable Arabic language for non professionals. • Write references in the required form (Thesis, Paper…….). • Demonstrate the thesis in a final power point presentation. • Continue self-learning throughout the experimental work and writing scientific papers.

5- Teaching and Learning Methods:

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

6- References:

- Websites: Pubmed, Sciencedirect, Weilyinterscience

Facilities required for:

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

---

- **Head of Department: Prof. Dr. Hanan Abdel Razik**

Masters of Pharmaceutical Organic chemistry

Program Courses		intended learning outcomes																												
		Knowledge and understanding									Intellectual skills								Professional and practical skills				General and transferable skills								
		A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	A 9	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8	C1	C2	C3	C4	D 1	D 2	D 3	D 4	D 5	D 6	D 7	D 8	D 9
General courses	Drug design					x																		x		x					
	Advanced Inst.Anal.& Chromatography	x	x								x															x					
	Physical chemistry	x			x		x				x		x											x				x			
	Good practice and quality control		x						x																			x			
	Drug stability						x																					x			
Special courses	Advanced Organic Chemistry: Structure and Mechanism	x											x		X								x	x		x			x	x	
	Advanced Organic Chemistry: Reactions and Synthesis	x										x	X			X	X						X	x		X			x	X	
	Advanced Heterocyclic Organic Chemistry	x		x								x	x			x							x	x		x			x	x	
Thesis		x	x	x	x	X	X				x	X	x	x	x	x	x		X	x	x		x	x	x	x	x	x	x	x	

Program and Course Specifications

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./ Aza M. Kadry and Prof. Dr./ Said A. H. El-Feky**
6- **Date of program specification approval:** 2018

B- Professional Information

Program aims:

1-1 To provide **the doctoral** students with a special and advanced education in the field of **Pharmaceutical Organic Chemistry.**
1-2 To develop the skills of researchers to become professionals and leaders in scientific research.

Graduate Attributes:

The PhD of Pharmaceutical Organic Chemistry aims to provide graduates with the opportunity to develop the following attributes, upon successful completion of the program, the graduate will be able to:

1- Plan and design of experimental skills.
2- Learn to use advanced chemical instrumentations to detect chemical structure.
3- Apply the various organic reactions in drug synthesis.
4- Illustrate combinatorial chemistry in drug discovery.
5- Contribute to scientific heritage by publishing research in specialized journals for pharmaceutical organic chemistry.
6- Demonstrate a high level of critical thinking, problem solving and decision making skills as a member of the research team.
7- Show Self-motivation, attention to detail, time-management and communication skills
8- Ask questions, create research hypotheses, and design methodologies to answer research questions.

9- Perform self-directed learning.
10- Contribute in the future as a supervisor or co-advisor for graduate students.

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 science 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 communities.

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 of 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:

- ARS (Academic Reference Standards)

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

	ARS	Program ILOs
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.
	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 specializations	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 communities.
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 a 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 - Master 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.
	2.3.2 - 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 learn and evaluate their performance.
	2.4.4 - Self-assessment and continuous working.	D.4 - Capable of 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.
	2.4.6 - 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 area of Pharmacy Practice. To fulfill this requirement the student must present (written and oral) a research proposal and write a thesis.

3- General University Requirements: 10 credit hours including:

a- TOEFL (500 units)
b- Computer course
c-number of semesters: 2 semester

c- Study plan:

Course Code	Course Title	Credit hours	Program ILOs Covered
	Special Courses:		
Osp4	Strategic Application of Named Reaction in Pharmaceutical Organic Synthesis	4	A1, A2, A3, B1, B2, D2, D4, D5, D7.
Osp5	The Organic Chemistry in Drug Synthesis	4	A1, A2, B1, B2, D2, D5, D6, D7.
Osp6	Current Trends in Pharmaceutical Organic Chemistry	4	A1, A2, A4, B3, B4, B7, B8, D2, D3, D4, D5, D6, D7.

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

d**. Learning Outcomes in Domains of Teaching Strategies & Assessment Methods:**

ILOs	Teaching method	Assessment method
Knowledge and Understanding Intellectual Skills	Lectures Self learning	Written and oral Exam
Professional and practical Skill	Problem solving Thesis	Practical work Problem discussion Rubric
Intellectual Skills General and Transferable Skills	Presentation Thesis	Oral Exam Rubric

5-Program admission requirements:

Applicants are admitted to PhD degree any time throughout the academic year upon fulfillment of the following:

1. The applicants should be holders of Bachelor in Pharmaceutical Sciences from any Faculty of Pharmacy and also complete M.Sc. degree of pharmacy affiliated to the Egyptian Universities affiliated to the Egyptian Supreme Council of Universities (ESCU).
2. Students should fulfill all the admission requirements stated by the concerned Departmental Board.

Regulations to complete the program:

Conditions of granting the degree

The Faculty Council, in compliance with the concerned Departmental Board as well as Graduate Studies and Research Committee recommendation awards the PhD degree upon fulfillment of the following requirements:

1. Carrying out a deep research in the area of specialization for at least two calendar years from the time of registration.
2. The student has to succeed in all courses examinations.
3. Acceptance of the research thesis by the judges Committee according to statement 104 of universities regulating law.

Cancellation of Registration

The Faculty Board is allowed to cancel registration for PhD programs in the following circumstances:

1. Student's failure to pass the course examinations for two times.
2. Student's non attendance or unsatisfactory progress in research work being reported by the advisors to the Departmental Board and forwarded to the Graduate Studies and Research Committee for approval of cancellation.
3. Dissertation refusal by the Jury Committee.
4. Incapability of the student to graduate by the deadlines indicated

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
presentation	Intellectual Skills and 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%
F	1	< 60%

8-Failure in Courses:

Students who fail to get 60% (1 point)

9-Methods of program evaluation

Evaluator	Tool
2- Candidates	(Questionnaires)
2-Stakeholders	(Questionnaires for staff members participating teaching)
3-External reviewer	
4- Internal reviewer	Prof. Dr. Eatedal H. Abdel aal
4-Others	Faculty board

Program coordinator: Prof. Dr./ Azza M. Kadry and Prof. Dr. Said A. H. El-Feky

Head of Department: Prof. Dr./ Hanan Abd El-Razik

تم اعتماد التوصيف بمجلس الكلية بتاريخ 2018

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: 2018

1- Basic information:

Title: **Strategic Application of named reaction in pharmaceutical organic synthesis** Code: Osp4
Credit hours: 4 hrs/week Lectures: 4 hrs/week
Total: 4 hrs/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.
- Apply the named reactions in the synthesis of some pharmaceutically active compounds.

3. Intended learning outcomes (ILOs) of Strategic application of named reaction in pharmaceutical organic synthesis:

Knowledge and Understanding	
a1	Enumerate various applicable named organic reactions.
a2	Describe the mechanisms of different named reactions.
a3	Mention different synthetic examples related to named reactions.
Intellectual skills	
b1	Predict the mechanism of named reactions.
b2	Evaluate the role of each reagent in a given named reactions.
General and Transferable skills	

d1	Contact effectively with professionals.
d2	Deals with computer and internet skills.
d4	Restore information from different sources.
d7	Run time successfully.
d8	Get independent learning.

4. Course Content of Strategic application of named reaction in pharmaceutical organic synthesis:

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

6- Student Assessment methods:

Written exams to assess: a1, a2, a3, b1 and b2
Oral exam to assess: a1, a2, a3, b1 and b2
Activity to assess: d1, d2, d4, d7and d8

Assessment schedule:

Assessment (1): Activity	Week 7
Assessment (2): Written exam	Week 16
Assessment (3): oral exam	Week 16

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

7- References and books:

A-Scientific papers

B- Essential books:

Strategic application of named reactions in organic synthesis

C- Websites:

www.sciencedirect.com

www.Pubmed.com

Facilities required for teaching and learning:

1. **For lectures:** boards, data show, screen, air conditioned class.

- **Course Coordinators: Prof Dr/ Azza Kadry, Said El Fiky**
- **Head of Department: Prof Dr/ Hanan Abdel Razik**
- **Date: 2018 -8 -27**

Matrix I of Strategic Application of Named Reaction in Pharmaceutical Organic Synthesis 2017-2018

Week number	Course Contents	Knowledge and understanding			Intellectual skills		General and Transferable skills				
		a1	**a2**	**a3**	**b1**	**b2**	**d1**	**d2**	**d4**	**d7**	**d8**
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**(Activity)**	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 2018-2019

ARS		Program ILOs	Course ILOs	Course content	Source	Teaching and learning methods				
						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	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.		Activity						X
	2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.			Scientific papers, text books and Internet					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.			Scientific papers, text books and Internet					X
	2.4.7- Manage time effectively.	D7- Run time successfully to get goals.								X
	2.4.8- Continuous and self-learning.	D8- Get independent learning for research studies.								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: 2018

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.
- Demonstrate a strong ability to undergo synthetic organic chemistry with some exposure to modern biology.

3. Intended learning outcomes (ILOs) of The Organic Chemistry in Drug Synthesis:

Knowledge and Understanding	
a1	Outline synthetic routes toward aliphatic, aromatic and heterocyclic drugs.
a2	Point out the importance of aliphatic, aromatic and heterocyclic moieties as cores for therapeutic agents.
Intellectual skills	
b1	Propose a facile route to know drugs.
b2	Evaluate the role that heterocyclic moieties play in the biological activity beyond simply providing a basic center for a good many agents.
General and Transferable skills	
d1	Contact effectively with professionals.
d2	Deals with computer and internet skills.
d4	Restore information from different sources.
d7	Run time successfully.
d8	Get independent learning.

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

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

	ring
10	Bicyclic fused heterocycles
11	Polycyclic fused heterocycles
12	Opioid analgesics
13	Seven-membered heterocycles fused to benzene ring
14	Heterocycles fused to two aromatic rings
15	Beta lactam antibiotics

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion

6- Student Assessment methods:

Written exam to assess: a1, a2, b1 and b2
Oral exam to assess : a1, a2, b1 and b2
Activity to assess: d1, d2, d4, d7, d8

Assessment schedule:

Assessment (1): Activity	**Week 7**
Assessment (2): Written exam	**Week 16**
Assessment (3): oral exam	**Week 16**

Weighting of Assessment:

Assessment method	Marks	Percentage
• **Presentation**	**10**	**10 %**
• **Written exam**	**75**	**75 %**
• **Oral exam**	**15**	**15 %**
TOTAL	**100**	**100%**

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 medicinal chemistry, Rama Rao Nadendla, 2005

D- Websites: Pubmed, Sciencedirect

Facilities required for teaching and learning:

1. **For lectures:** boards, data show, screen, air conditioned class

- **Course Coordinators: Prof Dr/ Azaa Kadry, Prof Dr/ Said El Fiky**
- **Head of Department: Prof Dr/ Hanan Abdel Razik**
- **Date: 2018 -8 -27**

Matrix I of The Organic Chemistry in Drug Synthesis 2017-2018

Week number	Course Contents	Knowledge and understanding		Intellectual skills		General and Transferable skills				
		a1	**a2**	**b1**	**b2**	**d1**	**d2**	**d4**	**d7**	**d8**
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 for 2018-2019

ARS		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 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/deduction).	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	
	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.		Activity						X
	2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.			Scientific papers, text books and Internet					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.			Scientific papers, text books and Internet					X
	2.4.7- Manage time effectively.	D7- Run time successfully to get goals.								X

	2.4.8- Continuous and self-learning.	D8- Get independent learning for research studies.								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: 2018

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.
- Utilize click chemistry in pharmaceutical organic synthesis.

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

Knowledge and Understanding	
a1	Illustrate the fundamentals of combinatorial chemistry and outline the operating principles associated with its most widely practiced forms.
a2	Point out the use of combinatorial chemistry technologies in pharmaceutical applications.
a3	Define the concept of click chemistry and demonstrate its potential value as a universal ligation strategy for drug synthesis and material science.
Intellectual skills	
b1	Recognize combinatorial chemistry as a powerful tool for drug discovery.
b2	Consider the use of click chemistry in drug synthesis.
General and Transferable skills	
d1	Contact effectively with professionals.
d2	Deals with computer and internet skills.
d4	Restore information from different sources.
d7	Run time successfully.
d8	Get independent learning.

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

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

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

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion

6- Student Assessment methods:

Written exams to assess: a1, a2, a3, b1 and b2
Oral exam to assess: a1, a2, a3, b1 and b2
Activity to assess: d1, d2, d4, d7, d8

Assessment schedule:

Assessment (1): Activity	Week 7
Assessment (2): Written exam	Week 16
Assessment (3): oral exam	Week 16

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %

• Oral exam	15	15 %
TOTAL	**100**	**100%**

7- References and books:

A-Scientific papers
B- Essential books:

- Combinatorial chemistry synthesis, analysis and screening.
- Click chemistry for Biotechnology and Materials sciences.
- **Websites/Journals:**
- www.sciencedirect.com, Pubmed.

Facilities required for teaching and learning:

1. **For lectures:** boards, data show, screen, air conditioned class

- **Course Coordinators: Prof Dr/ Azza Kadry, Prof Dr/Said El- Feky**
- **Head of Department: Prof Dr/ Hanan Abdel Razik**
- **Date: 2018 -8 -27**

Matrix I of Current Trends in Pharmaceutical Organic Chemistry 2017-2018

Week number	Course Contents	Knowledge and understanding			Intellectual skills		General and Transferable skills				
		a1	**a2**	**a3**	**b1**	**b2**	**d1**	**d2**	**d4**	**d7**	**d8**
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	Cupper catalyzed click chemistry			x		X					
14	Non-cupper catalyzed click chemistry			x		X					
15	Pharmaceutical applications of click chemistry			x	x	X					

Matrix II of Current Trends in Pharmaceutical Organic Chemistry for 2018-2019										
ARS		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	Scientific papers, text books and Internet	x	x	x	x	

				carbonyl group- Pharmaceutical applications of combinatorial chemistry						
	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- Cupper catalyzed click chemistry- Non-cupper 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- Cupper catalyzed click chemistry- Non-cupper 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		

General and Transferable skills	2.4.1- Communicate effectively.	D.1- Contact effectively with professionals.		Activity						X
	2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.			Scientific papers, text books and Internet					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.			Scientific papers, text books and Internet					X
	2.4.7- Manage time effectively.	D7- Run time successfully to get goals.								X
	2.4.8- Continuous and self learning.	D8- Get independent learning for research studies.								X

Thesis Specification

Thesis Specification of PhD Degree

A- Thesis 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:** 2018

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):

Knowledge and Understanding	
a1	Illustrate fundamentals and advanced knowledge in the field of Pharmaceutical organic chemistry that help to better understand the subject understudy.
a2	Determine methods, tools and techniques used during work.
a3	Carry out professional duties in accordance with legal and ethical guidelines.
a4	Define and apply quality bases during practical work.
a5	Describe the purpose of the research work and its impact on the community and human health.
Intellectual skills	
b1	Analyze and interpret the experimental data in a suitable form to utilize them properly.
b2	Propose a solution to the point understudy depending on available data.
b3	Carry out the research to add to the area of study.
b4	Develop writing skills such as clarity and presenting results to formulate scientific papers.
b5	Manage risks during dealing with chemical reagents.
b6	Improve the performance during the practical work.
b7	Make decisions related to recent and future studies.
b8	Be creative, innovative and original in one's approach to research.
b9	Discuss by theoretical evidences the whole work results.
Professional and practical skills	
c1	Perform practical experiments related to the point understudy.
c2	Report the work in a written report.
c3	Select appropriate methods and tools to support goals.
c4	Consider developments in technology and how to use to enhance learning.
c5	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
1st	• 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. • Collect all available information about this subject by all possible means. • Use internet, journals, books and others thesis to get previous and recent information about the subject understudy. • Design the protocol including the steps of work following the suitable timetable. • Increase the awareness of the recent chemical techniques that will be used during practical work and determined by the protocol. • Integrate different knowledge required to solve suggested problem. • Continuous evaluation to the thesis outcome according to the schedule.

2nd	• Identify different practical techniques and methods to assess chemical reactions related to the subject under study. • Modify methods and experiments used during practical work. • Evaluate and manage chemical hazards throughout the whole practical work. • Organize the experimental work according to the designed protocol. • Apply spectroscopic analysis for the new expected compounds (IR, ^{1}HNMR, Mass and elemental analysis). • Predict synthetic pathways and mechanisms. • Use all possible means to prove target compounds. • Apply ethical recommendations in all aspects of scientific research e.g. citation, publication……
3rd	• Select some of the compounds for their pharmacological or microbiological activities. • Interpret the biological results. • Perform statistical analysis and biological correlation for the results. • Present and describe the results graphically. • Understand any legal aspects related to the thesis work especially those related to dealing with chemicals.
4th	• Communicate with supervisors to discuss results. • Work effectively as a member of a team (e.g. Supervisors and various professionals). • Present the results periodically in seminars. • Write scientific reports on the obtained results with conclusive significance. • Discuss obtained results in comparison with pervious literatures. • Suggest possible recommendations based on the outcome of

	the thesis and decide future plans. • Present the thesis in a written form. • Summarize the thesis in an understandable Arabic language for non professionals. • Write references in the required form (Thesis, Paper…….). • Demonstrate the thesis in a final power point presentation. • Continue self-learning throughout the experimental work and writing scientific papers.

5- Teaching and Learning Methods:

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

6- References:

- Websites: Pubmed, Sciencedirect, Weilyinterscience

Facilities required for:

For practical work: Heaters with magnetic stirrer- UV lamp- Rotary evaporator- Ice machine- Infrared- 1HNMR- Mass Spectrometer- Vacuum pump

---

- **Head of Department: Prof. Dr. Hanan Abdel Razik**

Matrix of PhD program of Pharmaceutical Organic Chemistry

Program Courses		Program intended learning outcomes																																						
		Knowledge and understanding											Intellectual skills												Professional and practical skills							General and transferable skills								
		A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	A 9	A 10	A 11	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8	B 9	B 10	B 11	B 12	C 1	C 2	C 3	C 4	C 5	C 6	C 7	D 1	D 2	D 3	D 4	D 5	D 6	D 7	D 8	D 9
Special courses	Strategic Application of Named Reaction in Pharmaceutical Organic Synthesis	x												x			x															x	x		x			x	x	
	The Organic Chemistry in Drug Synthesis	x											X		x																	x	x		x			x	x	X
	Current Trends in Pharmaceutical Organic Chemistry	x	x	x														x	x														x		x			x	x	
Thesis		x	X	X	x	x							X	x	X	x	x	x	x	x	X				x	x	x	x	x			x	x	x	x	x	X	x		X