Master of Pharmaceutical Organic chemistry																								
Program Courses		A program intended learning outcomes																						
		Knowledge and understanding						Intellectual skills							Professional and practical skills			General and transferable skills						
		A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	D1	D2	D3	D4	D5	D6	D7	D8
	Advanced Inst.Anal.& Chromatography	x						x											x						
	Physical chemistry	x						x		x									x				x		
	Drug design			x															x						
	Good practice and quality control	x				x		x				x							x		x				
	Drug stability	x											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	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

Matrix II of Advanced Organic Chemistry: Structure and Mechanism in 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 - Illustrate the principles of advanced organic chemistry and its related subjects including advanced heterocyclic chemistry,	a1	.Valence bond and molecular orbital theories .Factors affecting molecular structure .Stereochemistry and conformation .Stereoselectivity .Structural effects on stability and reactivity .Photochemistry	Scientific papers, text books and Internet	x	x	X	X	

		fundamentals of combinatorial chemistry, organic chemistry of drug synthesis, instrumental analysis, spectrophoto metry, electrochemistry, physical chemistry, chemical kinetics and drug stability.	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	b2	Stereochemistry and conformation- Stereoselectivity	Scientific papers, text books and Internet	x	x	x	x	

		recovery of a pure target.								
	2.2.5- Evaluate and manage risks and potential hazards in professional practices in the area of specialization	B.5-Manage risks during dealing with chemical reagents	b3	Aromaticity	Scientific papers, text books and Internet	x	x	x	x	
General and Transferable Skills	2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.	d1	Activity	Scientific papers, text books and Internet					X
	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.	d2							x
	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.	d3							X

	2.4.8- Continuous and self learning.	D.8- Get independent learning for research studies.	d4							X

Matrix II of Advanced Organic Chemistry: Reactions and Synthesis for 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 - Illustrate the principles of advanced organic chemistry and its related subjects including advanced heterocyclic chemistry, fundamentals of combinatorial chemistry, organic chemistry of drug synthesis, instrumental analysis, spectrophotometry, electrochemistry, physical chemistry, chemical kinetics and drug stability.	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	b4	Synthetic equivalence and control of stereochemistry- Illustrative examples for multistep synthesis	Scientific papers, text books and Internet	x	x	x	X	

		recovery of a pure target.								
	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	
	2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.	d1	Activity	Scientific papers, text books and Internet					X
	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.	d2		Scientific papers, text books and Internet					X
	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.	d3							

	2.4.7- Manage time effectively.	D7- Run time successfully to get goals.	d4							X
	2.4.8- Continuous and self learning.	D8- Get independent learning for research studies.	d5							X

Matrix II of Advanced Heterocyclic Organic Chemistry for 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 - Illustrate the principles of advanced organic chemistry and its related subjects including advanced heterocyclic chemistry, fundamentals of combinatorial chemistry, organic chemistry of drug synthesis, instrumental analysis, spectrophotometry,	a1	Heterocyclic nomenclature-Structures and spectroscopic properties of aromatic heterocycles	Scientific papers, text books and Internet	x	x	x	X	

		electrochemistry, physical chemistry, chemical kinetics and drug stability.	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 - Outline recent applications of organic chemistry in drug synthesis as well as drug design and development.	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	

	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.	d1		Scientific papers, text books and Internet					X
General and Transferable Skills	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.	d2							X
	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.	d3		Scientific papers, text books and Internet					
	2.4.7- Manage time effectively.	D7- Run time successfully to get goals.	d4							X
	2.4.8- Continuous and self learning.	D8- Get independent learning for research studies.	d5							X

Master Thesis (Pharmaceutical Organic Chemistry)				
ARS		Program ILOs	Thesis ILOs	Thesis content
Knowledge and Understanding	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.1 - Illustrate the principles of advanced organic chemistry and its related subjects including advanced heterocyclic chemistry, fundamentals of combinatorial chemistry, organic chemistry of drug synthesis, instrumental analysis, spectrophotometry, electrochemistry, physical chemistry, chemical kinetics and drug stability.	Understand all required knowledge related to thesis work.	• Collect all available information about this subject by all possible means.
	2.1.2- Mutual influence between professional practice and its impact on the environment.	A.2 – Describe different methods of synthesis of novel advantageous drug candidates.	Select the point of the thesis according to the problems present in the community.	• 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.
	2.1.3- Scientific developments in the area of specialization.	A.3 - Outline recent applications of organic chemistry in drug synthesis as well as drug design and development.	Be aware with recent techniques and developments that can be used during study.	• Increase the awareness of the recent chemical techniques that will be used during practical work and determined by the protocol.

	2.1.4- Moral and legal principles for professional practice in the area of specialization.	A.4- Be aware with the legal authorities for professional practices in advanced organic chemistry.	Understand any legal aspects related to the thesis work.	• Understand any legal aspects related to the thesis work espically those related to dealing with chemicals.
	2.1.5- Principles and the basics of quality in professional practice in the area of specialization.	A.5- Determine the basics to good laboratory practice and quality assurance in advanced organic chemistry.	Demonstrate GLP and quality assurance related to practical work of the thesis.	• Identify different practical techniques and methods to assess chemical reactions related to the subject understudy.
	2.1.6- The fundamentals and ethics of scientific research.	A.6- Outline clearly full consciousness of ethics in all aspects of scientific research.	Identify and apply scientific experimental ethics.	• Apply ethical recommendations in all aspects of scientific research e.g citation, publication……..
Intellectual Skills	2.2.1- Analyze and evaluate information in the field of specialization and analogies to solve problems	B.1 - Interpret quantitative and qualitative experimental data as well as spectroscopic data in a specific and a suitable form to identify new organic compounds.	Analyze and interpret the experimental data in a suitable form to solve the suggested problem.	• Select some 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.
	2.2.2- Solve specified problems in the lack or missing of some information.	B.2- Employ the available data to predict the synthetic pathways and mechanisms.	Apply analysis and predict synthetic pathways to solve the problem understudy.	• Predict synthetic pathways and mechanisms. • Apply spectroscopic analysis for the new expected compounds (IR, 1HNMR, Mass and elemental analysis.

	2.2.3-Correlate and integrate different pharmaceutical knowledge to solve professional problems.	B.3- Evaluate the expected problems and side reactions that might emerge during the synthesis and successfully find out the necessary precautions for the recovery of a pure target.	Integrate all required knowledge to solve problems and side reactions that may rise during practical work.	• Integrate different knowledge required to solve suggested problem.
	2.2.4- Conduct research and write scientific report on research specified topics.	B.4- Design full schemes on the obtained results with conclusive significances.	Conduct a research project and write scientific reports.	• Write scientific reports on the obtained results with conclusive significance.
	2.2.5- Evaluate and manage risks and potential hazards in professional practices in the area of specialization	B.5-Manage risks during dealing with chemical reagents	Manage risks and hazards during dealing with chemical reagents.	Evaluate and manage chemical hazards throughout the whole practical work.
	2.2.6- Plan to improve performance in the field of specialization.	B.6- Improve a laboratory schemes for an advanced organic chemistry issue.	Design a laboratory protocol for the work.	• Design the protocol including the steps of work following the suitable timetable. Suggest possible recommendations based on the outcome of the thesis and decide future plans.

	2.2.7- Professional decision-making in the contexts of diverse disciplines.	B.7- Take professional decisions in proving target compounds.	Make decisions related to recent and future studies.	•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. -Suggest possible recommendations based on the outcome of the thesis and decide future plans. - Use all possible means to prove 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.	Perform practical experiments related to the point understudy.	• Predict synthetic pathways and mechanisms. • Apply spectroscopic analysis for the new expected compounds (IR, 1HNMR, Mass and elemental analysis. -Use all possible means to prove target compounds.
	2.3.2- Write and evaluate professional reports.	C.2- Write down and discuss results in the form of thesis and scientific papers.	Report the work in a written report.	• 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…….).

	2.3.3- Assess methods and tools existing in the area of specialization.	C.3- Choose and implement perfectly the proper techniques during practical work .	Asses used methods, tools and instruments in the research.	• Identify different practical techniques and methods to assess chemical reactions related to the subject understudy.
General and Transferable Skills	2.4.1- Communicate effectively.	D.1- Contact effectively with professionals.	Communicate effectively with professionals.	• Communicate with supervisors to discuss results.
	2.4.2- Effectively use information technology in professional practices	D.2- Deals with computer and internet skills for collecting scientific materials.	Use information technology in review and thesis preparation.	• Present the results periodically in seminars • Demonstrate the thesis in a final power point presentation.
	2.4.3- Self-assessment and define his personal learning needs.	D.3- Persuit self estimation in advanced organic chemistry for personal learning needs.	Evaluate the work and learning needs.	• Continuous evaluation to the thesis outcome according to the schedule.
	2.4.4- Use variable sources to get information and knowledge.	D.4- Restore information from different sources in the field of advanced organic chemistry	Use various sources to get information about the subject understudy.	• Use internet, journals, books and others thesis to get previous and recent information about the subject understudy.
	2.4.5- Set criteria and parameters to evaluate the performance of others	D.5- Apply standards for judging others performance in the field of advanced organic chemistry.	Set rules for evaluation and judging others performance.	• Discuss obtained results in comparison with pervious literatures.
	2.4.6- Work in a team and lead teams carrying out various professional tasks.	D.6- Activate working as a member of a team.	Work effectively as a member of a team.	• Work effectively as a member of a team (e.g. Supervisors and various professionals).

Matrix II of Strategic Application of Named Reaction in Pharmaceutical Organic Synthesis 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 as well as Current Trends in Pharmaceutical Organic Chemistry.	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- Integrate theoretical background in organic chemistry 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.4 - Manage risks during dealing with chemical reagents.	b2	Named reactions starting with the letters A,B,C,D,E,F,G,H,I,G,K,L,M,N,O,P,Q,R,S,T,U, V,W,X,Y,Z	Scientific papers, text books and Internet	x	x	x	x	
General and Transferable skills	2.4.1- Communicate effectively.	D.1- Contact effectively with professionals.	d1	Activity						X
	2.4.2- Effectively use information technology in professional practices	D.2-Improve professional practices using the information technology.	d2		Scientific papers, text books and Internet					X
	2.4.4- Use variable sources to get information and knowledge.	D.4- Self evaluation and continue to learn independentl y to develop professionall y	d3 d5		Scientific papers, text books and Internet					X
	2.4.7- Manage time effectively.	D7- Run time successfully to get goals.	d4							X

Matrix II of The Organic Chemistry in Drug Synthesis for 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 as well as Current Trends in Pharmaceutical Organic Chemistry.	a1	Open-chain compounds- Alicyclic compounds- Monocyclic aromatic compounds- Carbocyclic compounds fused to benzene ring- Five-membered heterocycles- Six-membered heterocycles- Five-membered heterocycles fused to one benzene ring- Six-membered heterocycles fused to one benzene ring- Bicyclic fused heterocycles- Polycyclic fused heterocycles- Seven-membered heterocycles fused to benzene ring- Heterocycles fused to two aromatic rings	Scientific papers, text books and Internet	x	x	x	x	
			a2	Compounds related to progesterone, cortisone and cholesterol- Opioid analgesics- Beta lactam antibiotics	Scientific papers, text books and Internet	x	x	x	x	

Intellectual Skills	2.2.1- Analyze, evaluate the data in his / her specified area, and utilize them in logical inference processes (induction/deduction).	B.1- Analyze, evaluate and discuss information and results 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 a research study in the field of synthesis of pharmaceuticals.	b2	Opioid analgesics- Beta lactam antibiotics	Scientific papers, text books and Internet	x	x	x	x	
General and Transferable skills	2.4.1- Communicate effectively.	D.1- Contact effectively with professionals.	d1	Activity						X
	2.4.2- Effectively use information technology in professional practices	D.2- Improve professional practices using the information technology.	d2		Scientific papers, text books and Internet					X
	2.4.5- Use variable sources to get information and knowledge.	D.5- Use computer and internet skills to get information and knowledge.	d3		Scientific papers, text books and Internet					X
	2.4.7- Manage time effectively.	D7- Run time successfully to get goals.	d4							X
	2.4.4- Continuous and self-learning.	D4- Capable of self-evaluation and continue to learn	d5							X

		independently to develop professionally.								

Matrix II of Current Trends in Pharmaceutical Organic Chemistry for 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 as well as Current Trends in Pharmaceutical Organic Chemistry.	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	Scientific papers, text books and Internet	x	x	x	x	

				phase synthesis-Combinatorial chemistry of the carbonyl group-Pharmaceutical applications of combinatorial chemistry						
	2.1.2-Fundamentals, methods, techniques, tools and ethics of scientific research.	A.2- Outline 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-Describe 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	Scientific papers, text books and Internet	x	x	x	x	

				applications of click chemistry							
Intellectual Skills	2.2.6- Plan to improve performance in the pharmaceutical area of interest.	B.5 - 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.6 - 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	Scientific papers, text books and Internet	x	x	x	x		

				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						
General and Transferable skills	2.4.1- Communicate effectively.	D.1- Contact effectively with professionals.	d1	Activity						X
	2.4.2- Effectively use information technology in professional practices	D.2- Improve professional practices using the information technology.	d2		Scientific papers, text books and Internet					X
	2.4.5- Use variable sources to get information and knowledge.	D.5- Use computers and internet skills to get information and knowlegde	d3		Scientific papers, text books and Internet					X

	2.4.7- Manage time effectively.	D7- Run time successfully to get goals.	d4							X
	2.4.4- Continuous and self learning.	D4. self-evaluation and continue to learn independently to develop professionally.	d5							X

PhD Thesis (Pharmaceutical Organic Chemistry)				
	ARS	Program ILOs	Thesis ILOs	Thesis content
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.	Illustrate fundamentals and advanced knowledge in the field of Pharmaceutical organic chemistry that help to better understand the subject understudy.	• Collect all available information about this subject by all possible means.
	2.1.2- Fundamentals, methods, techniques, tools and ethics of scientific research.	A.2-Deal with all fundamentals, methods, techniques, tools and ethics of scientific research.	Determine methods, tools and techniques used during work.	• Increase the awareness of the recent chemical techniques that will be used during practical work and determined by the protocol. • Identify different practical techniques and methods to assess chemical reactions related to the subject under study.
	2.1.3- The ethical and legal principles in pharmacy and academic practices.	A.3-Be aware with the legal authorities for professional practices in pharmacy and academic practices .	Carry out professional duties in accordance with legal and ethical guidelines.	• Apply ethical recommendations in all aspects of scientific research e.g. citation, publication…… • Understand any legal aspects related to the thesis work especially those related to dealing with chemicals.
	2.1.4- The principles and bases of quality assurance in professional practice in the field of specialization.	A.4-Determine the bases of quality assurance in synthetic pharmaceutical organic chemistry.	Define and apply quality bases during practical work.	• Identify different practical techniques and methods to assess chemical reactions related to the subject understudy.

	2.1.5- All relevant knowledge concerning the impact of professional practice on society and environment and the ways of their conservation and development.	A.5- Display awareness of all knowledge in both scientific and social community.	Describe the purpose of the research work and its impact on the community and human health.	• 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.
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.	Analyze and interpret the experimental data in a suitable form to utilize them properly.	• Select some 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.
	2.2.2- Propose solutions to specified problems in the light of the available data (information).	B.2- Investigate accurately the practical results and correlate them with the theoretical background to overcome emerging difficulties in the research process.	Propose a solution to the point understudy depending on available data.	• Integrate different knowledge required to solve suggested problem. • Apply spectroscopic analysis for the new expected compounds (IR, 1HNMR, Mass and elemental analysis). • Predict synthetic pathways and mechanisms. • Use all possible means to prove target compounds.

	2.2.3- Conduct research studies that add to the current knowledge.	B.3- Construct an outstanding research study in the field of synthesis of pharmaceutical important compounds.	Carry out the research to add to the area of study.	• 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. • Design the protocol including the steps of work following the suitable timetable.
	2.2.4- Formulate scientific papers.	B.4- Collect all practical and theoretical data to design scientific paper.	Develop writing skills such as clarity and presenting results to formulate scientific papers.	• Write scientific reports on the obtained results with conclusive significance.
	2.2.5- Assess hazards and risks in professional practice in his / her area of specialization.	B.5- Manage risks during dealing with chemical reagents.	Manage risks during dealing with chemical reagents.	• Evaluate and manage chemical hazards throughout the whole practical work.
	2.2.6- Plan to improve performance in the pharmaceutical area of interest.	B.6- Improve a laboratory schemes for an advanced organic chemistry issue.	Improve the performance during the practical work.	• Design the protocol including the steps of work following the suitable timetable. Suggest possible recommendations based on the outcome of the thesis and decide future plans.

	2.2.7- Take professional decisions and bears responsibility in wide array of pharmaceutical fields.	B.7- Take professional and scientific decisions regarding emerging situations and needs in the field of pharmaceutical synthesis.	Make decisions related to recent and future studies.	•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. -Suggest possible recommendations based on the outcome of the thesis and decide future plans. - Use all possible means to prove target compounds.
	2.2.8- Be creative and innovative.	B.8- Demonstrate creativity and innovation in the field of pharmaceutical organic chemistry.	Be creative, innovative and original in one's approach to research.	• Modify methods and experiments used during practical work.
	2.2.9- Manage discussions and arguments based on evidence and logic.	B.9- Discuss by theoretical evidences the whole work results.	Discuss by theoretical evidences the whole work results.	• Communicate with supervisors to discuss results. • Present the results periodically in seminars.

Professional and Practical Skills	2.3.1- Mastery of basic and modern professional skills in the area of specialization.	C.1- Perform Professionally high laboratory techniques for synthesis and purification of the target pharmaceuticals.	Perform practical experiments related to the point understudy.	• Identify different practical techniques and methods to assess chemical reactions related to the subject under study. • Modify methods and experiments used during practical work. • Apply spectroscopic analysis for the new expected compounds (IR, 1HNMR, Mass and elemental analysis). • Predict synthetic pathways and mechanisms. • Use all possible means to prove target compounds.
	2.3.2- Write and critically evaluate professional reports.	C.2- Estimate all data and write professional reports.	Report the work in a written report.	• Write scientific reports on the obtained results with conclusive significance. • Summarize the thesis in an understandable Arabic language for non professionals. • Write references in the required form (Thesis, Paper…….).
	2.3.3- Evaluate and develop methods and tools existing in the area of specialization.	C.3- Select appropriate methods and tools to support goals.	Select appropriate methods and tools to support gools.	•Identify different practical techniques and methods to assess chemical reactions related to the subject under study. • Modify methods and experiments used during practical work.

	2.3.4- Properly use technological means in a better professional practice.	C.4- Use the most recent techniques to improve performance.	Consider developments in technology and how to use to enhance learning.	• 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. • Present the results periodically in seminars • Demonstrate the thesis in a final power point presentation.
	2.3.5- Plan to improve professional practices and to improve the performance of other scholars.	C.5- Work to enhance professional practices and performance.	Improve the performance during the practical work.	• Modify methods and experiments used during practical work. • Design the protocol including the steps of work following the suitable timetable. -Suggest possible recommendations based on the outcome of the thesis and decide future plans.
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.	Communicate effectively in different forms.	• Communicate with supervisors to discuss results. • Present the results periodically in seminars.
	2.4.2- Efficiently use the information technologies (IT) in improving the professional practices.	D.2- Improve professional practices using the information technology.	Be competent in the use of computers for data analysis, word-processing, and production of thesis-quality graphics.	• Use internet, journals, books and others thesis to get previous and recent information about the subject understudy.• Perform statistical analysis and biological correlation for the results. • Present and describe the results graphically.

	2.4.3- Help others to learn and evaluate their performance.	D.3- Guide others to learn and evaluate their performance.	Evaluate the performance of others and assist them to develop.	• Discuss obtained results in comparison with pervious literatures.
	2.4.4- Self- assessment and continuous learning.	D.4- Capable to self-evaluation and continue to learn independently to develop professionally.	Recognize self-limitations and areas for improvement and seek for continuous learning.	• Continuous evaluation to the thesis outcome according to the schedule. • Continue self-learning throughout the experimental work and writing scientific papers.
	2.4.5- Use various sources to get information and knowledge.	D.5- Use computer and internet skills to get information and knowledge.	Gather, summarize, and organize information from different sources.	• Use internet, journals, books and others thesis to get previous and recent information about the subject understudy.
	2.4.6- Work as a member and lead a team of workers.	D.6- Activate working as a member of a team.	Implement tasks as a member of a team.	• Work effectively as a member of a team (e.g. Supervisors and various professionals).
	2.4.7- Direct scientific meetings and to manage time effectively.	D.7- Run time successfully to reach goals.	Utilize time effectively to achieve goals.	• Organize the experimental work according to the designed protocol.

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						
		A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5	D6	D7
Special courses	Strategic Application of Named Reaction in Pharmaceutical Organic Synthesis	x						x			x								x	x		x			x
	The Organic Chemistry in Drug Synthesis	x					x		x										x	x		x	x		x
	Current Trends in Pharmaceutical 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