



Course Specification of Pharmaceutical Organic Chemistry I

I. Course Identification and General Information:					
1	Course Title	Pharmaceutical Organic Chemistry I			
2	Course Number & Code:	Ph522			
3	Credit hours:	C.H			Total
		Th.	Pr.	Tr.	
		2	2		
4	Study level/ semester at which this course is offered:	1 st Level /2 nd Semester			
5	Pre –requisite (if any):	General Pharmaceutical Chemistry			
6	Co –requisite (if any):	-			
7	Program (s) in which the course is offered:	Bachelor of Pharmacy			
8	Language of teaching the course:	English			
9	The department in which the course is offered:	Department of Medicinal Chemistry, Pharmaceutical Organic and Analytical Chemistry			
10	Location of teaching the course:	Faculty of Pharmacy-Sana`a University			
11	Prepared by:	Dr. Mokhtar A. Al-Ghorafy			
12	Date of approval:				

II. Course description:

This course is intended to provide students with the fundamental knowledge of aliphatic compounds including the nomenclatures, properties, synthesis, chemical reactions and the pharmaceutical application of these compounds. Some practical differentiation methods are also provided.



III. Intended learning outcomes (ILOs) of the course:

At the end of this course the students should be able to:

1. Recognize the basic principles of pharmaceutical organic chemistry.
2. Describe the factors affecting the chemical reactivity and orbital hybridization.
3. Recognize the type of chemical bonds, reaction mechanisms and their application in the synthesis of simple medicinal agents.
4. Illustrate the classification, IUPAC nomenclature, physical, chemical properties, preparation and reactions of hydrocarbons.
5. Predict the methods of preparation of the aliphatic organic compounds.
6. Understand the reaction mechanisms and effect of conditions on the type of products.
7. Discuss the differences between the types of hydrocarbons.
8. Diagram the schemes that relate all the reactions of hydrocarbons.
9. Select the suitable methods for identification of organic compounds in accordance with their physical and chemical properties of functional groups.
10. Identify organic compounds from their physical and chemical properties
11. Operate different equipment and instruments.
12. Handle chemicals according to safety guidelines.
13. Use the principle rules to solve problem and questions related to the course.
14. Work effectively in a team to perform the required tasks.
15. Manage, organize the time effectively and implement writing and presentation skills

IV. Intended learning outcomes (ILOs) of the course:

(A) Knowledge and Understanding:

Alignment Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs) in:
Knowledge and Understanding.

Program Intended Learning Outcomes (Sub- PILOs) in: Knowledge and Understanding	Course Intended Learning Outcomes (CILOs) in: Knowledge and Understanding
After completing this program, students would be able to:	After participating in the course, students would be able to:



A1-	Recognize the principles of physical, chemical, clinical, social, behavioral, health and pharmaceutical sciences.	a1-	Recognize the basic principles of pharmaceutical organic chemistry.
		a2-	Describe the factors affecting the chemical reactivity and orbital hybridization.
	Recognize the physicochemical properties, preparation, structure activity relationship (SAR), toxicity and the modern methods of analysis of various substances of chemical and natural products of therapeutic potential as well as the basic principle of drug discovery, design and development.	a3-	Recognize the type of chemical bonds, reaction mechanisms and their application in the synthesis of simple medicinal agents.
		a4-	Illustrate the classification, IUPAC nomenclature, physical, chemical properties, preparation and reactions of hydrocarbons.

Teaching And Assessment Methods For Achieving Learning Outcomes:

Alignment Learning Outcomes of Knowledge and Understanding to Teaching and Assessment Methods:

Course Intended Learning Outcomes (CILOs) in Knowledge and Understanding After participating in the course, students would be able to:		Teaching strategies/methods to be used	Methods of assessment
a1-	Recognize the basic principles of pharmaceutical organic chemistry.	Lecture method , Computer based teaching and learning, group discussion and tutorial	Oral Exam, Quizzes, Attendance, Participation, Short answers, reports, homework, and Written exam.
a2-	Describe the factors affecting the chemical reactivity and orbital hybridization.		
a3-	Recognize the type of chemical bonds, reaction mechanisms and their application in the synthesis of simple medicinal agents.		
a4-	Illustrate the classification, IUPAC nomenclature, physical, chemical properties, preparation and reactions of hydrocarbons.		

(B) Intellectual Skills:



Alignment Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs) in: Intellectual skills			
Program Intended Learning Outcomes (Sub-PILOs) in Intellectual skills		Course Intended Learning Outcomes (CILOs) of Intellectual Skills	
After completing this program, students would be able to:		After participating in the course, students would be able to:	
B1-	Consolidate the chemical, biochemical and physiological principles to construct the pharmacophores of the structure and their effect on the stability, pharmacokinetic and pharmacodynamic profiles of the drug.	b1- Predict the methods of preparation of the aliphatic organic compounds.	
B2-	Categorize the synthetic and natural drugs according to their mechanism of action, systemic effect, therapeutic uses, contraindication and toxicity.	b2- Understand the reaction mechanisms and effect of conditions on the type of products.	
		b3- Discuss the differences between the types of hydrocarbons.	
		b4- Diagram the schemes that relate all the reactions of hydrocarbons	
		b5- Select the suitable methods for identification of organic compounds in accordance with the physical and chemical properties of functional groups.	
Teaching And Assessment Methods For Achieving Learning Outcomes:			
Alignment Learning Outcomes of Intellectual Skills to Teaching Methods and Assessment Methods:			
Course Intended Learning Outcomes (CILOs) in Intellectual Skills.		Teaching strategies/methods to be used.	Methods of assessment
After participating in the course, students would be able to:			
b1-	Predict the methods of preparation of the aliphatic organic compounds.	Lecture method, Computer based teaching and learning Group Discussion, Problem solving sessions and brainstorming	Oral Exam, Quizzes, Attendance, Participation, Short answers, reports, homework, and Written exam.
b2-	Understand the reaction mechanisms and effect of conditions on the type of products.		
b3-	Discuss the differences between the types of hydrocarbons.		
b4-	Diagram the schemes that relate all the reactions of hydrocarbons		
b5-	Select the suitable methods for identification of organic compounds in		



	accordance with the physical and chemical properties of functional groups.		
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(C) Professional and Practical Skills.

Alignment Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs) in: Professional and Practical Skills

Program Intended Learning Outcomes (Sub- PILOs) in Professional and Practical Skills		Course Intended Learning Outcomes (CILOs) in Professional and Practical Skills	
After completing this program, students would be able to:		After participating in the course, students would be able to:	
C1-	Operate different pharmaceutical equipments and instruments and use emerging technologies in design, synthesis, pre-formulation, formulation, packaging, storage and analysis of pharmaceutical products according to GLP, GSP and cGMP guidelines.	c1-	Identify organic compounds from their physical and chemical properties
C2-	Handle and dispose chemicals and pharmaceutical preparations including radiopharmaceuticals safely and effectively.	c2-	Operate different equipment and instruments in the lab.
C5-	Conduct research studies and utilize the results in different pharmaceutical fields.	c3-	Handle chemicals according to safety guidelines

Teaching And Assessment Methods For Achieving Learning Outcomes:

Alignment Learning Outcomes of Professional and Practical Skills to Teaching and Assessment Methods:

Course Intended Learning Outcomes (CILOs) in Professional and Practical Skills		Teaching strategies/methods to be used	Methods of assessment
After participating in the course, students would be able to:			
c1-	Identify organic compounds from their physical and chemical properties	Lecture method, Practical sessions and group discussion	Practical works, homework, practical discussion
c2-	Operate different equipment and instruments in the lab.		



c3-	Handle chemicals according to safety guidelines		exam and practical reports.
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(D) General / Transferable Skills:

Alignment Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs) in: **General and Transferable skills**

Program Intended Learning Outcomes (PILOs) in General / Transferable skills		Course Intended Learning Outcomes (CILOs) in General / Transferable skills	
After completing this program, students would be able to:		After participating in the course, students would be able to:	
D3-	Develop financial, market management, writing, presentation and time management skills as well as creativity, critical thinking, problem solving and decision making abilities.	d1-	Use the principle rules to solve problem and questions related to the course.
D5-	Apply information and communication technology and working effectively in a team.	d2-	Work effectively in a team to perform the required tasks.
		d3-	Manage, organize the time effectively and implement writing and presentation skills

Teaching And Assessment Methods For Achieving Learning Outcomes:

Alignment Learning Outcomes of General and Transferable skills to Teaching and Assessment Methods.

Course Intended Learning Outcomes (CILOs) in General and Transferable Skills		Teaching strategies/methods to be used.	Methods of assessment
After participating in the course, students would be able to:			
d1-	Use the principle rules to solve problem and questions related to the course.	Small group discussions, Tutorials and Practical sessions.	Homework, and reports.
d2-	Work effectively in a team to perform the required tasks.		
d3-	Manage, organize the time effectively and implement writing and presentation skills		

V. Course Content:

1 – Course Topics/Items:



a – Theoretical Aspect

Order	Topic List / Units	CILOs (symbols)	Sub-topic List	Number of weeks	Contact hours
1	Introduction to Pharmaceutical Organic Compounds: The Fundamentals of Pharmaceutical Organic Chemistry	a1-a3, d1-d3	- Introduction, solubility , type of chemical bonds, - hybridization and their types - chemical bonding in drug–receptor interactions -Representation of organic compounds, type of isomerism, electronic effects (inductive & resonance), and Steric effect -Types chemical bond cleavage The effect of cleavage of bond on drug stability Applications in physical and chemical properties of drugs	2	4
2	Organic reactions	a3,b2, ,d1-d3	-Type of organic reactions, and type of their mechanisms: -Substitution -Addition -Elimination -Types of reagents	1	2
3	Alkanes	a3-a4,b1,b3, b4, b5, d1-d3	- Nomenclature, preparations, and reaction properties), and free radical substitution reaction mechanism. -Pharmaceutical importance of alkane (action, activity ,stability and metabolism)	1	2
4	Alkenes	a3-a4,b1,b3, b4, b5, d1-d3	-Alkenes and cycloalkenes (nomenclature, preparations, and reaction properties), and elimination & addition reaction mechanism -Pharmaceutical importance of alken (Isomer , activity , stability and metabolism)	2	4



5	Alkynes	a3-a4,b1,b3, b4, b5, d1-d3	-Alkynes (nomenclature, preparations, and properties), acidity of acetylene physical and chemical properties of alkyne group in drug structure	1	2
6	Organic halides	a3-a4,b1,b3, b4, b5, d1-d3	- Alkyl halides (nomenclature, preparations, and properties), Nucleophilic substitution reactions mechanism, and reactions of organometallic compounds. -Pharmaceutical importance of alkyl halide in drug synthesis	1	2
7	Mid Exam	a1-4, b1-5		1	2
8	Alcohols	a3-a4,b1,b3, b4, b5, d1-d3	- Alcohols (nomenclature, preparations, and properties), esterification reaction mechanisms – Ethers (nomenclature, preparations, and properties) physical and chemical properties of drugs contain alcohol functional group (prodrug and metabolism)	1	2
9	Aldehydes and Ketones	a3-a4,b1,b3, b4, b5, d1-d3	-Aliphatic aldehydes & Ketones (nomenclature, preparations, and properties), Addition, condensation (Aldol) reaction mechanism, and cannizaro reaction -Pharmaceutical importance of Aliphatic aldehydes & Ketones in synthesis and stability of drugs	2	4
10	Carboxylic Acid	a3-a4,b1,b3, b4, b5, d1-d3	-Aliphatic carboxylic acids (nomenclature, preparations, and properties), factors affecting on the acidity of drugs	1	2



11	Derivatives of Carboxylic Acid	a3-a4,b1,b3, b4, b5, d1-d3	-Acyl halides -Anhydride -Esters -Amides -Stability of drugs containing one or more of that compounds	1	2
12	Amines	a3-a4,b1,b3, b4, b5, d1-d3	-Aliphatic amines (nomenclature, preparations, and properties), factors affecting on the basicity of drugs	1	2
13	Final Exam	a1-4, b1-5		1	2
Number of Weeks /and Units Per Semester				16	32

b - Practical Aspect				
Order	Tasks/ Experiments	CILOs (symbols)	Number of Weeks	Contact Hours
1	Laboratory Safety	c1-3,d1-3	1	2
2	Combustion Experiments (benzene and hexane)	c1-3,d1-3	1	2
3	Test of Alcohols	c1-3,d1-3	1	2
4	Test of Aldehydes	c1-3,d1-3	1	2
5	Test of Ketones	c1-3,d1-3	1	2
6	Mid-Exam	c1-3	1	2
7	Test of Acids and their Derivatives	c1-3,d1-3	2	4
8	Test of Ammonium Salt	c1-3,d1-3	1	2
9	Lassaigne's Test ,Test for Nitrogen	c1-3,d1-3	1	2
10	Identification of Amines	c1-3,d1-3	1	2



11	Test for Sulfur	c1-3,d1-3	1	2
12	Test for Halogen in Absence of Nitrogen and Sulfur	c1-3,d1-3	1	2
13	Fisher Method of Esterification (preparation of ethylacetate)	c1-3,d1-3	1	2
14	Revision	c1-3,d1-3	1	2
16	Final Exam	c1-3	1	2
Number of Weeks /and Units Per Semester			16	32

VII. a-Teaching Strategies of the Course:

Lecture method, computer based teaching and learning group discussion, brainstorming and Problem solving sessions, tutorial, Practical sessions and group discussion

b- Assessment Methods:

Oral Exam, Quizzes, Attendance, Participation, Short answers, reports, homework, and Written exam
Practical works, practical exam and practical reports.

VII. Assignments:

No.	Assignments	Aligned CILOs (symbols)	Week Due	Mark
1	Homework Assignments	a1- 4, b2,b2-3, d1-3	Sporadic through the semester	10
2	Reports	c1-3, d1-3		

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes (CILOs symbols)



1	Attendance, Participation, reports and quizzes	All Weeks	10	7%	a1, a3, b1, b4,b5, d1-3
	Oral Tests and Homework-assignments	Sporadic through the semester	10	7%	a1- 4, b2,b2-3, d1-3
2	Attendance, Practical Reports and Practical mid-semester exam	6 th	30	20%	c1-3
3	Theoretical mid-semester exam	9 th	30	20%	a1-4, b1-5
5	Final Exam (theoretical)	16 th	50	33%	a1-4, b1-5
6	Final Exam (practical)	16 th	20	13%	c1-3
Total			150	100%	

IX. Students' Support:

Office Hours/week	Other Procedures (if any)
Two contact hours per week	None

X. Learning Resources:

1- Required Textbook(s) (maximum two).

- 1- R. T. Morrison and R. N. Boyd. 2002. Organic Chemistry, 6th edition, Pearson Prentice Hall of India Pvt. Ltd, New Delhi.
- 2- Francis A. Carey and Richard J. Sundberg. 2001. Advanced Organic Chemistry; Part B: Reactions and Synthesis, 4thedition, Wiley and Sons., Inc. New York.
- 3- Michael Heidelberger. 1923. Advanced Laboratory Manual of Organic Chemistry, The chemical catalog company, inc. New York.

2- Recommended Books and Reference Materials.

1. L. Finar., ,1963. Organic Chemistry: The Fundamental Principles, 4th edition, longman green and company ltd. London.



	<ol style="list-style-type: none"> 2. John McMurry. 2011, " Fundamentals of Organic Chemistry " Seventh Edition, Brooks/Cole 20 Davis Drive, Belmont. 3. Jerry and March,. 2007,. Advanced Organic Chemistry ; reaction, mechanism and structure, 6th edition, John Wiley & Sons, Inc., Hoboken, New Jersey 4. Janice Gorzynski Smith. 2011,." Organic Chemistry", Third Edition, McGraw-Hill, a business unit of The McGraw-Hill Companies, New York. 5. Lectures Notes and Practical Manual.
3- Electronic Materials and Web Sites etc.	
	<ol style="list-style-type: none"> 1- http://www.chemaxon/marvin 2- www.orgsyn.org.
XI. Facilities Required:	
1 - Accommodation:	<ul style="list-style-type: none"> - Well-equipped lecture halls with data show facilities, whiteboards, net connection, etc. - Well-equipped laboratories with all required equipment and reagents.
2 - Computing resources:	<ul style="list-style-type: none"> - Computer laboratory with internet facilities.
XII. Course Improvement Processes:	
1- Strategies for Obtaining Student Feedback on Effectiveness of Teaching	
	<ul style="list-style-type: none"> ▪ Student-based assessment of the effectiveness of teaching using a questionnaire designed by the Quality Assurance Unit at the end of the semester. ▪ Meeting with students and faculty (once per semester).
2- Other Strategies For Evaluation of Teaching by the Instructor or by the Department.	
	<ul style="list-style-type: none"> ▪ Assessment of the course syllabus and contents by the teachers using a questionnaire designed by the Quality Assurance Unit of the university at the end of the semester. ▪ Regular meeting and discussion of the course content between the Head of Department and the teaching staff of the course (for theory and practice).
3- Processes for Improvement of Teaching.	
	<ul style="list-style-type: none"> ▪ Revision of the course specification and its teaching strategies every three academic years after consideration of all issues raised by the teachers and/or students during regular meetings and discussions.



	<ul style="list-style-type: none"> Exploring any possible defects in the course that might be encountered by the teaching staff and their mitigation in subsequent improved versions of course specification.
4- Processes for Verifying Standards of Students' Achievement	
	<ul style="list-style-type: none"> Checking of a sample of students' work by an independent faculty member. Periodic exchange and check marking of a sample of students' assignments with a faculty member from another institution. Adoption of scoring rubrics to assess the students' achievement (both for ongoing or summative assessments). Regular follow-up of laboratory logbooks to assess the practical achievement of students.
5- Procedures for Periodically Reviewing of Course Effectiveness and Planning for Improvement	
	<ul style="list-style-type: none"> Student rating and feedback Peer rating and feedback Regular meeting of the Curriculum Committee of the faculty.
6- Course Development Plans	
	<ul style="list-style-type: none"> Conducting regular workshops for the staff for improving their course specification skills. Regular revision of course specification and syllabus items.

XIII. Course Policies: (including plagiarism, academic honesty, attendance etc)

The University Regulations on academic misconduct will be strictly enforced. Please refer to -----

1	Class Attendance: <ul style="list-style-type: none"> Attendance of all lectures and practical sessions is required. Unexcused absence exceeding 25% of the lectures or practical sessions will disqualify the student from entering the final exam.
2	Tardy: <p>- Roll will be called in the very beginning of each lecture and practical class. Retardation for more than three weeks without a reasonable excursion, the student involved shall not be allowed to attend the class any longer and consequently shall be considered to be absent.</p>
3	Exam Attendance/Punctuality: <ul style="list-style-type: none"> Exam attendance is obligatory unless being excused by the department and faculty.



	<ul style="list-style-type: none">Absence from assignments or exams will be dealt with according to the general policy of the university.
4	Assignments & Projects: <ul style="list-style-type: none">Assignments: Written and oral; Laboratory logbook signed by the responsible demonstrator.Projects: Not applicable.
5	Cheating: <ul style="list-style-type: none">Punishment of cheating will be according to the general policy of the university in this respect.
6	Plagiarism: <ul style="list-style-type: none">Plagiarism in written essays, reports, etc. is not accepted, and students who plagiarize the works of others will be punished according to the general policy of the university.
7	Other policies: <ul style="list-style-type: none">General policies of the Students' Affairs of the University and the Quality Assurance Unit.

Course Plan of Pharmaceutical Organic Chemistry I

I- Information about Faculty Member Responsible for the Course:		
Name of Faculty Member	Dr. Mokhtar A. Al-Ghorafy	Office Hours



Location & Telephone No.	770010749	SAT	SUN	MON	TUE	WED	THU
E-mail	Alghorafi2030@yahoo.com	2h					

II- Course Identification and General Information:						
1-	Course Title:	Pharmaceutical Organic Chemistry I				
2-	Course Number & Code:	Ph522				
3-	Credit hours:	C.H			C.H	
		Th.	Seminar	Pr.	F. Tr.	Th.
		2		2		2
4-	Study level/year at which this course is offered:	1 st Level / 2 nd Semester				
5-	Pre –requisite (if any):	General Pharmaceutical Chemistry				
6-	Co –requisite (if any):	-				
7-	Program (s) in which the course is offered	Bachelor of Pharmacy				
8-	Language of teaching the course:	English				
9-	System of Study:	Semesters				
10-	Mode of delivery:	Regular				
11-	Location of teaching the course:	Faculty of Pharmacy- Sana`a university				

III- Course description:

This course is intended to provide students with the fundamental knowledge of aliphatic compounds including the nomenclatures, properties, synthesis, chemical reactions and the pharmaceutical application of these compounds. Some practical differentiation methods are also provided.

IV- Intended learning outcomes (ILOs) of the course:

رئيس الجامعة
إ.د. القاسم محمد عباس

مركز التطوير الأكاديمي وضمان الجودة
إ.د. هدى العماد

عميد الكلية
إ.د. خالد الشويبه

وحدة ضمان الجودة
إ.د. محمود البريهي



At the end of this course the students should be able to:

1. Recognize the basic principles of pharmaceutical organic chemistry.
2. Describe the factors affecting the chemical reactivity and orbital hybridization.
3. Recognize the type of chemical bonds, reaction mechanisms and their application in the synthesis of simple medicinal agents.
4. Illustrate the classification, IUPAC nomenclature, physical, chemical properties, preparation and reactions of hydrocarbons.
5. Predict the methods of preparation of the aliphatic organic compounds.
6. Understand the reaction mechanisms and effect of conditions on the type of products.
7. Discuss the differences between the types of hydrocarbons.
8. Diagram the schemes that relate all the reactions of hydrocarbons.
9. Select the suitable methods for identification of organic compounds in accordance with their physical and chemical properties of functional groups.
10. Identify organic compounds from their physical and chemical properties
11. Operate different equipment and instruments.
12. Handle chemicals according to safety guidelines.
13. Use the principle rules to solve problem and questions related to the course.
14. Work effectively in a team to perform the required tasks.
15. Manage, organize the time effectively and implement writing and presentation skills

V- Course Content:

1 – Course Topics/Items:

a – Theoretical Aspect

Order	Topic List / Units	CILOs (symbols)	Sub-topic List	Week Due	Contact hours
1	Introduction to Pharmaceutical Organic Compounds: The fundamentals of Pharmaceutical Organic Chemistry	a1-a3, d1-d3	- Introduction, solubility, type of chemical bonds, - hybridization and their types - chemical bonding in drug-receptor interactions -Representation of organic compounds, type of isomerism, electronic effects (inductive & resonance), and Steric effect	1,2	4

رئيس الجامعة
إ.د. القاسم محمد عباس

مركز التطوير الأكاديمي وضمان الجودة
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عميد الكلية
إ.د. خالد الشويه

وحدة ضمان الجودة
إ.د. محمود البريهي



			-Types chemical bond cleavage The effect of cleavage of bond on drug stability Applications in physical and chemical properties of drugs		
2	Organic reactions	a3,b2, ,d1-d3	-Type of organic reactions, and type of their mechanisms: -Substitution -Addition -Elimination -Types of reagents	3	2
3	Alkanes	a3-a4,b1,b3, b4, b5, d1-d3	- Nomenclature, preparations, and reaction properties), and free radical substitution reaction mechanism. -Pharmaceutical importance of alkane (action, activity ,stability and metabolism)	4	2
4	Alkenes	a3-a4,b1,b3, b4, b5, d1-d3	-Alkenes and cycloalkenes (nomenclature, preparations, and reaction properties), and elimination & addition reaction mechanism -Pharmaceutical importance of alken (Isomer , activity , stability and metabolism)	5,6	4
5	Alkynes	a3-a4,b1,b3, b4, b5, d1-d3	-Alkynes (nomenclature, preparations, and properties), acidity of acetylene physical and chemical properties of alkyne group in drug structure	7	2
6	Organic halides	a3-a4,b1,b3, b4, b5, d1-d3	- Alkyl halides (nomenclature, preparations, and properties), Nucleophilic substitution reactions mechanism, and reactions of organometallic compounds.	8	2



			-Pharmaceutical importance of alkyl halide in drug synthesis		
7	Mid Exam	a1-4, b1-5		9	2
8	Alcohols	a3-a4,b1,b3, b4, b5, d1-d3	- Alcohols (nomenclature, preparations, and properties), esterification reaction mechanisms – Ethers (nomenclature, preparations, and properties) physical and chemical properties of drugs contain alcohol functional group (prodrug and metabolism)	10	2
9	Aldehydes and ketones	a3-a4,b1,b3, b4, b5, d1-d3	-Aliphatic aldehydes & Ketones (nomenclature, preparations, and properties), Addition, condensation (Aldol) reaction mechanism, and cannizaro reaction -Pharmaceutical importance of Aliphatic aldehydes & Ketones in synthesis and stability of drugs	11,12	4
10	Carboxylic acid	a3-a4,b1,b3, b4, b5, d1-d3	-Aliphatic carboxylic acids (nomenclature, preparations, and properties), factors affecting on the acidity of drugs	13	2
11	Derivatives of carboxylic acid	a3-a4,b1,b3, b4, b5, d1-d3	-Acyl halides -Anhydride -Esters -Amides -Stability of drugs containing one or more of that compounds	14	2
12	Amines	a3-a4,b1,b3, b4, b5, d1-d3	-Aliphatic amines (nomenclature, preparations, and properties), factors affecting on the basicity of drugs	15	2
13	Final Exam	a1-4, b1-5		16	2
Number of Weeks /and Units Per Semester				16	32



b - Practical Aspect				
Order	Tasks/ Experiments	CILOs (symbols)	Week Due	Contact Hours
1	Laboratory Safety	c1-3,d1-3	1	2
2	Combustion Experiments (benzene and hexane)	c1-3,d1-3	2	2
3	Test of Alcohols	c1-3,d1-3	3	2
4	Test of Aldehydes	c1-3,d1-3	4	2
5	Test of Ketones	c1-3,d1-3	5	2
6	Mid-Exam	c1-3	6	2
7	Test of Acids and their Derivatives	c1-3,d1-3	7,8	4
8	Test of Ammonium Salt	c1-3,d1-3	9	2
9	Lassaigne's Test ,Test for Nitrogen	c1-3,d1-3	10	2
10	Identification of Amines	c1-3,d1-3	11	2
11	Test for Sulfur	c1-3,d1-3	12	2
12	Test for Halogen in Absence of Nitrogen and Sulfur	c1-3,d1-3	13	2
13	Fisher method of esterification (preparation of ethylacetate)	c1-3,d1-3	14	2
14	Revision	c1-3,d1-3	15	2
16	Final Exam	c1-3	16	2
Number of Weeks /and Units Per Semester			16	32

VIII. a-Teaching strategies of the course:

رئيس الجامعة
إ.د. القاسم محمد عباس

مركز التطوير الأكاديمي وضمان الجودة
إ.د. هدى العماد

عميد الكلية
إ.د. خالد الشويه

وحدة ضمان الجودة
إ.د. محمود البريهي



Lecture method, computer based teaching and learning group discussion, brainstorming and Problem solving sessions, tutorial, Practical sessions and group discussion

b- Assessment Methods:

Oral Exam, Quizzes, Attendance, Participation, Short answers, reports, homework, and Written exam
Practical works, practical exam and practical reports.

VII. Assignments:

No.	Assignments	Aligned CILOs (symbols)	Week Due	Mark
1	Homework Assignments	a1- 4, b2,b2-3, d1-3	Sporadic through the semester	10
2	Reports	c1-3, d1-3		

XIV. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes (CILOs symbols)
1	Attendance, Participation, reports and quizzes	All Weeks	10	7%	a1, a3, b1, b4,b5, d1-3
	Oral Tests and Homework-assignments	Sporadic through the semester	10	7%	a1- 4, b2,b2-3, d1-3
2	Attendance, Practical Reports and Practical mid-semester exam	6 th	30	20%	c1-3
3	Theoretical mid-semester exam	9 th	30	20%	a1-4, b1-5
5	Final Exam (theoretical)	16 th	50	33%	a1-4, b1-5
6	Final Exam (practical)	16 th	20	13%	c1-3



	Total	150	100%	
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XV. Students' Support:

Office Hours/week	Other Procedures (if any)
Two contact hours per week	None

XVI. Learning Resources:

1- Required Textbook(s) (maximum two).

- 4- R. T. Morrison and R. N. Boyd. 2002. Organic Chemistry, 6th edition, Pearson Prentice Hall of India Pvt. Ltd, New Delhi.
- 5- Francis A. Carey and Richard J. Sundberg. 2001. Advanced Organic Chemistry; Part B: Reactions and Synthesis, 4th edition, Wiley and Sons., Inc. New York.
- 6- Michael Heidelberger. 1923. Advanced Laboratory Manual of Organic Chemistry, The chemical catalog company, inc. New York.

2- Recommended Books and Reference Materials.

6. L. Finar., 1963. Organic Chemistry: The Fundamental Principles, 4th edition, longman green and company ltd. London.
7. John McMurry. 2011, " Fundamentals of Organic Chemistry " Seventh Edition, Brooks/Cole 20 Davis Drive, Belmont.
8. Jerry and March., 2007,. Advanced Organic Chemistry ; reaction, mechanism and structure, 6th edition, John Wiley & Sons, Inc., Hoboken, New Jersey
9. Janice Gorzynski Smith. 2011, " Organic Chemistry", Third Edition, McGraw-Hill, a business unit of The McGraw-Hill Companies, New York.
10. Lectures Notes and Practical Manual.

3- Electronic Materials and Web Sites *etc.*

- 3- <http://www.chemaxon/marvin>
- 4- www.orgsyn.org.

XVII. Facilities Required:



<p>1 - Accommodation:</p>	<ul style="list-style-type: none"> - Well-equipped lecture halls with data show facilities, whiteboards, net connection, etc. - Well-equipped laboratories with all required equipment and reagents.
<p>3 - Computing resources:</p>	<ul style="list-style-type: none"> - Computer laboratory with internet facilities.
<p>XVIII. Course Improvement Processes:</p>	
<p>6- Strategies for obtaining student feedback on effectiveness of teaching</p>	
	<ul style="list-style-type: none"> ▪ Student-based assessment of the effectiveness of teaching using a questionnaire designed by the Quality Assurance Unit at the end of the semester. ▪ Meeting with students and faculty (once per semester).
<p>7- Other strategies for evaluation of teaching by the instructor or by the department.</p>	
	<ul style="list-style-type: none"> ▪ Assessment of the course syllabus and contents by the teachers using a questionnaire designed by the Quality Assurance Unit of the university at the end of the semester. ▪ Regular meeting and discussion of the course content between the Head of Department and the teaching staff of the course (for theory and practice).
<p>8- Processes for improvement of teaching.</p>	
	<ul style="list-style-type: none"> ▪ Revision of the course specification and its teaching strategies every three academic years after consideration of all issues raised by the teachers and/or students during regular meetings and discussions. ▪ Exploring any possible defects in the course that might be encountered by the teaching staff and their mitigation in subsequent improved versions of course specification.
<p>9- Processes for verifying standards of students' achievement</p>	
	<ul style="list-style-type: none"> ▪ Checking of a sample of students' work by an independent faculty member. ▪ Periodic exchange and check marking of a sample of students' assignments with a faculty member from another institution. ▪ Adoption of scoring rubrics to assess the students' achievement (both for ongoing or summative assessments). ▪ Regular follow-up of laboratory logbooks to assess the practical achievement of students.
<p>10- Procedures for Periodically Reviewing Of Course Effectiveness And Planning For Improvement</p>	



	<ul style="list-style-type: none"> ▪ Student rating and feedback ▪ Peer rating and feedback ▪ Regular meeting of the Curriculum Committee of the faculty.
6- Course Development Plans	
	<ul style="list-style-type: none"> ▪ Conducting regular workshops for the staff for improving their course specification skills. ▪ Regular revision of course specification and syllabus items.

XIX. Course Policies: (including plagiarism, academic honesty, attendance etc)

The University Regulations on academic misconduct will be strictly enforced. Please refer to -----

1	Class Attendance: <ul style="list-style-type: none"> ▪ Attendance of all lectures and practical sessions is required. Unexcused absence exceeding 25% of the lectures or practical sessions will disqualify the student from entering the final exam.
2	Tardy: <p>- Roll will be called in the very beginning of each lecture and practical class. Retardation for more than three weeks without a reasonable excursion, the student involved shall not be allowed to attend the class any longer and consequently shall be considered to be absent.</p>
3	Exam Attendance/Punctuality: <ul style="list-style-type: none"> ▪ Exam attendance is obligatory unless being excused by the department and faculty. ▪ Absence from assignments or exams will be dealt with according to the general policy of the university.
4	Assignments & Projects: <ul style="list-style-type: none"> ▪ Assignments: Written and oral; Laboratory logbook signed by the responsible demonstrator. ▪ Projects: Not applicable.
5	Cheating: <ul style="list-style-type: none"> ▪ Punishment of cheating will be according to the general policy of the university in this respect.
6	Plagiarism: <ul style="list-style-type: none"> ▪ Plagiarism in written essays, reports, etc. is not accepted, and students who plagiarize the works of others will be punished according to the general policy of the university.
7	Other policies: <ul style="list-style-type: none"> ▪ General policies of the Students' Affairs of the University and the Quality Assurance Unit.

Republic of Yemen
Ministry of Higher
Education and Scientific
Research
Sana'a University
Faculty of Pharmacy
Quality Assurance Unit



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كلية الصيدلة
وحدة ضمان الجودة

رئيس الجامعة
ا.د. القاسم محمد عباس

مركز التطوير الأكاديمي وضمان الجودة
ا.د. هدى العماد

عميد الكلية
ا.د. خالد الشويه

وحدة ضمان الجودة
ا.د. محمود البريهي