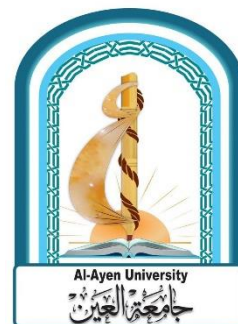




Republic of Iraq
Ministry of Higher Education & Scientific Research
Supervision and Scientific Evaluation Directorate
Quality Assurance and Academic Accreditation
International Accreditation Dept.



Al-Ayen University

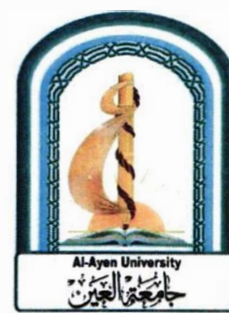
Academic Program Specification for Pharmaceutical chemistry Department 2022-2023

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Republic of Iraq
Ministry of Higher Education & Scientific Research
Supervision and Scientific Evaluation Directorate
Quality Assurance and Academic Accreditation
International Accreditation Dept.
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Academic Program Specification Form 2022-2023

University: Al-Ayen University

College: Pharmacy

Name of the Department: Pharmaceutical chemistry

Date Of Form Completion: 25/9/2022

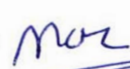
Head of department:
Dr.Khulood Hayal Oudah

Date: / /

Signature 

Dean's Assistant:
Dr. Mazin Abdalghani Najm

Date: / /

Signature  

The File verified by the Quality Assurance and University Performance Manager

Date: / /

Signature 

Al-Ayen University

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Dean's Approval

Date: / /

Signature 



PROGRAM SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

PROGRAM SPECIFICATION

This program specification provides a concise summary of the main features of the program and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It is supported by a specification for each course that contributes to the program.

1. Educational institution	Ministry of Higher Education and Scientific Research – Al-Ayen University
2. University department / Center	College of pharmacy
3. Academic program	Pharmaceutical chemistry
4. The title of the final granted degree	Bachelor of Pharmacy
5. The educational system	Courses system
6. Accreditation program	Under preparation
7. Other external influences	Theoretical lectures + Educational laboratories
8. Date of description form preparation//Revision of this specification	25/9/2022

9. Academic Program Objective.

1-To provide students with a good theoretical background in chemical principals that is essential to practice chemical analysis.

2-It enables students to understanding the importance of judging the accuracy and precision of experimental data and techniques of quantitative analysis.

3- Show that theory frequently serves as useful guide to the solution of analytical problems.

4-It enables the student to recognize the types of titrations to determine the chemical materials and pharmaceutical compounds.

10. Required program outcomes and teaching, learning, and assessment methods.

A. Cognitive goals

- A1. Statement of the basic principles in analytical chemistry.
- A2. Conducting practical experiments of theoretical concepts.
- A3. Preparing short reports.
- A4. Enabling the students to develop knowledge and laboratory skills through laboratory work and by using many chemical technologies and devices.

B. The skill goals of the program

- B1. Enabling the students to use the instruments and laboratory devices.
- B2. Enabling the students to acquire self-learning skills to acquire new information, skills and knowledge.
- B3. Enabling the students to acquire the skills of using scientific research tools in the academic and scientific fields.
- B4. Make seminars in different objects.

Teaching and learning methods for cognitive and skills goals:

- 1 Lectures
- 2- Conducting practical experiments
- 3 Reading scientific books
- 4- Conducting scientific discussions

Assessment methods

- 1 oral and written tests
- 2 practical exams after each experiment
- 3 theoretical semester exam
- 4 final theoretical exam

C. Affective and value goals

- C1. Developing students' sense of belonging and loyalty to the homeland.
- C2. Educating the students to respect human dignity.
- C3. Educating the students on professional humanitarian work.
- C4. Promote and consolidate the professional and ethical values among students to practice the profession of pharmacist.

Teaching and learning methods

- 1. Lectures
- 2. Conducting experiments
- 3. Reading textbooks
- 4. Conducting scientific discussions

Assessment methods

- 1. Observing students' interaction with patients
- 2. Case-based scenarios
- 3. Homework
- 4. Conducting volunteer campaigns
- 5. Questionnaires

D. General and rehabilitative transferred skills (other skills relevant to employability and personal development)

- D1. Designing and implementing laboratory experiments using modern equipment and devices.
- D2. Analyzing, interpreting and evaluating the experimental data and making a quantitative evaluation of errors in the experimental measurements.
- D3. Applying computer programs to analyze the experimental data and write the scientific reports.
- D4. Using the literature to write a report on the data of a particular experiment.

Teaching and learning methods

- 1 Write a report on an experiment and explain the result
- 2 Use of computer
- 3- Doing homework
- 4- Conducting seminars on different topics

Assessment methods

Skills are assessed through report writing and continuing with written examinations and short exams

11. The program structure

Level/ Stage	Course code	Course Title	Credit Hours	
			Theoretical	Practical
first	PH1103	Analytical Chemistry	2	2
	PHH1204	Organic Chemistry I	3	2
second	PH2101	Organic Chemistry II	3	2
	PH2201	Organic Chemistry III	2	2
third	PH3101	Inorganic Pharmaceutical Chemistry	3	2
	PH3201	Organic Pharmaceutical Chemistry I	3	2
fourth	PH4102	Organic Pharmaceutical Chemistry II	3	2
	PH4202	Organic Pharmaceutical Chemistry III	3	2
fifth	PH5101	Organic Pharmaceutical Chemistry IV	2	-
	PH5204	Advanced Pharmaceutical Analysis	2	2

12. Planning for personal development

- 1-Preparing a curriculum plan for each subject by the teaching staff.
- 2- Follow the program carefully.
- 3- Prepare questions, discussions, and theoretical and practical examinations and evaluate the student for her role.
- 4- Determine the most important obstacles that we faced in implementing the program and the performance self-evaluation

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13. Admission Criteria

This is done according to the acceptance rate in the medical group (Faculty of Pharmacy) within the electronic form approved by the Ministry of Higher Education and Scientific Research (central admission). The central admission standards have been applied to the college since the 2017 academic year.

14. The most important sources of information about the program

- Fundamentals of Analytical chemistry by Skoog and West 10th.ed. 2021.
- Chemical Analysis in the Laboratory A Basic Guide, by Mueller-Harvey and R. M. Baker, ISBN 0-85404-646-1
- Organic Chemistry by Robert T. Morrison and Robert N. Boyd last ed.
- Organic Chemistry by McCurry; 5th ed. Thomason learning; CA,USA; 2000
- An introduction to the chemistry of heterocyclic compound by Acheson, R. M.latest ed
- Inorganic Medicinal and Pharmaceutical Chemistry by Block, Roche Soine and Wilson, latest edition
- Wilson and Gisvold Textbook of Organic medicinal and Pharmaceutical chemistry, Delgado JN, Remers WA, (Eds); 12th ed, 2011.
- Spectrometric Identification of Organic Compounds by Silverstein, Bassler and Morrill; 2. Applications of absorption spectroscopy of organic compounds by Dyer JR.
- Organic Chemistry by McMurry; 5th ed; Thomason learning CA, USA last ed.

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COURSE SPECIFICATION

This course description provides a necessary summary to introduce overview of analytical chemistry delineates between quantitative and descriptive analysis, focusing on methods for concentration expression and the ionic equilibrium constant. It explores volumetric and gravimetric analysis techniques while also delving into spectroscopic

1. Educational institution	Al-ayen University - College of Pharmacy
2. College department/Center	Pharmaceutical chemistry
3. Course title/code	Analytical Chemistry PH1103
4. Modes of Attendance offered	Full-time and official attendance hours
5. Semester/Year	First semester 2022-2023
6. Credits (total)	45 hrs + 30 hrs practical
7. Date of description form preparation//Revision of this specification	25/9/2022
8. Course Objectives	
Introduction to analytical chemistry...the difference between quantitative and descriptive analysis - methods for expressing concentrations - the ionic equilibrium constant - volumetric analysis methods - gravimetric analysis methods - and spectroscopic methods for estimating drug compounds.	

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جامعة العين

9. Learning Outcomes, Teaching, Learning and Assessment Method

A. Cognitive goals

- A1- Statement of knowledge and basic principles in chemistry
- A2- Conducting practical experiments of theoretical concepts
- A3-Preparation of explanatory aids
- A4-Preparing brief reports

B. The skills goals special to the course

- B1-Providing graduates with balanced, thoughtful knowledge and teaching them to assume ethical responsibility in professions related to health care.
- B2- Providing information and technical skills to meet the diverse pharmaceutical needs in the public and private sectors.
- B3- That the college becomes an educational source based on research and focusing on cooperation between pharmaceutical sciences and the pharmaceutical industry.
- B4 - Emphasizing commitment to lifelong learning in order to communicate the rapid developments in pharmaceutical sciences to enable graduates to compete in the labor market and serve society.

Teaching and Learning Methods

Seminars - daily assignments - oral exams

Assessment methods

Oral exams and scientific reports

C. Affective and value goals

- C1 Asking questions about topics that can be discussed by students
- C 2 Asking questions that the student solves for the classroom
- C 3 Conduct quick intellectual exams
- C4- Preparing reports on chemicals and their analysis methods

Teaching and Learning Methods

- Providing the student with the basics and topics related to knowledge
- Clarification and explanation of study materials by the teaching staff
- Asking students to visit the library to obtain academic knowledge
- Request reports and seminars on the topics covered

Assessment methods

- 1. Statement of knowledge and basic principles in chemistry
- 2. Conducting practical experiments of theoretical concepts
- 3. Preparing short reports

D. General and rehabilitative transferred skills (other skills relevant to employability and personal development)

- D1- Acquire the skill of safe handling of chemicals and glassware.
- D 2- Acquire the skill of writing scientific reports and research accurately and effectively.

D 3- Acquire skill in implementing chemical diagnosis methods for chemical substances.

D 4- Acquire skill in using books and modern educational means to achieve personal development and develop educational capabilities.



10. Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1.	3	1A,2A, ,4A,1B,2B,3B, ,1C,2C,3C, ,1D,2D, ,4D	Review of elementary concept important to analytical chemistry	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam 4- Final exam
2.	3	1A, ,3A,4A,1B,2B,3B,4B,1C,2C,3C, ,1D,2D,3D,	Knowing strong and weak electrolytes , importance weight and concentration		
3.	3	1A,2A,3A,4A,1B,2B,3B,4B, 1C,2C,3C,4C,1D,2D,3D,4D	The evaluation to Analytical data, definition of terms.		
4.	2	1A,2A, ,4A,1B,2B, ,4B,1C,2C,3C,4C,1D,2D,3D,	volumetric analysis classification		
5.	3	,2A,3A,4A,1B,2B,3B, ,1C,2C,3C,4C,1D,2D,3D,	Knowing buffer and ionic equilibrium precipitation methods		
6.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Mid Examination		
7.	2	1A,2A,3A,4A,1B,2B,3B,4B ,1C,2C,3C,4C,1D,2D,3D,4D	application of gravimetric analysis , inorganic and organic precipitating agents		
8.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	application of gravimetric analysis , inorganic and organic precipitating agents		
9.	3	1A,2A,3A,4A,1B,2B,3B, ,2C,3C,4C,1D,2D,3D,4D	methods of analysis, volumetric base -calculations acidequilibria and PH calculations		
10.	3	1A,2A,3A,4A,1B,2B,3B,4B, ,2C,3C,4C,1D,2D,3D,4D	methods of analysis, volumetric base -calculations acidequilibria and PH calculations		
11.	3	1A,2A,3A,4A, ,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	titrations of complex systems		
12.	3	1A,2A, ,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,	titrations of complex systems		
13.	3	1A,2A,3A,4A,1B,2B, ,4B,1C,2C,3C,4C,1D,2D ,4D	Knowing of Spectrophotometric method define		
14.	3	1A, ,3A,4A,1B,2B,3B,4B,2C,3C,4C,1D,2D,3D,4D	Spectrophotometric method define ,Beer-Lamert, Application , Instrumentation		
15.			Final Examination		

10. Laboratory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1.	2	1A,2A,3A, 1B,2B,3B, ,1C,2C,3C,4C,1D,2D,3D,4D	Laboratory safety rules	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam
2.	2	1A,2A, ,4A,1B,2B,3B,4B,1C,2C,3C, ,1D,2D,3D,4D	Glassware laboratory		
3.	2	1A, ,3A,4A,1B,2B,3B,4B,1C, ,3C,4C,1D,2D,3D,4D	Prepare solutions from solids and liquids		
4.	2	1A,2A,3A,4A,1B,2B,3B, ,1C,2C,3C,4C, ,3D,4D	Volumetric analysis (Titration)		
5.	2	1A,2A,3A,4A,1B,2B,3B,4B, ,2C,3C,4C,1D ,3D,4D	Titration of hydrochloric acid with sodium carbonate solution		
6.	2	1A,2A,3A,4A,1B,2B, ,4B,1C,2C,3C,4C,1D,2D,3D	Titration of hydrochloric acid with sodium hydroxide solution		
7.	2		Mid Examination		
8.	2	1A,2A,3A, ,1B,2B,3B,4B,1C,2C,3C,4C,1D, ,3D,4D	Titration of potassium permanganate solution with sodium oxalate		
9.	2	1A,2A,3A,4A,1B ,3B,4B, ,2C,3C,4C,1D,2D,3D,4D	Titration of potassium permanganate solution with ferrous sulfate		
10.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2 C,3C,4C,1D,2D,3D,4D	Determination of chloride by the Mohr method		
11	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2 C,3C,4C,1D,2D,3D,4D	Determination of a water hardness		
12	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2 C,3C,4C,1D,2D,3D,4D	Determination of Ca ion using Erchrom black T		
13.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2 C,3C ,2D,3D,4D	Gravimetric analysis		
14.	2	1A,2A,1B,2B,3B,4B,1C,2C,3C,4 C,1D,2D,3D,4D	Gravimetric analysis		
15.			Final Examination		

11. Infrastructure	
Books Required reading	Fundamentals of Analytical Chemistry by Stook and West, last ed.
Main references (sources)	Fundamentals of Analytical Chemistry by Stook and West, last ed.
Recommended books and references (scientific journals, reports...).	Scientific journals
Electronic references, Internet sites...	Website of universities

12. Course development plan

Developing curricula to suit the development in the chemical structures of medicines and training students to work in chemical laboratories and use chemical reactions in the manufacture of medicines with active groups. In addition to various methods of analysis and the use of reagents.

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COURSE SPECIFICATION

This course description provides a necessary summary to the study of organic chemistry encompasses essential chemical groups crucial in pharmacy, such as aldehydes, ketones, carboxylic acids, amines, benzene derivatives, and phenols, focusing on their properties, nomenclature, interactions, and preparation methods. Qualitative detection methods are explored to analyze composition and differentiate compounds, emphasizing safe handling procedures and chemical detection techniques. Overall, students gain insight into both theoretical and practical aspects of organic chemistry, facilitating safe and proficient interaction with chemical compounds.

1. Educational institution	Al-Ayen University - College of Pharmacy
2. College department/Center	Pharmaceutical chemistry
3. Course title/code	Organic chemistry I PH1204
4. Modes of Attendance offered	Full-time and official attendance hours
5. Semester/Year	Second semester 2022-2023
6. Credits (total)	45 hrs+ 30 hrs practical
7. Date of description form preparation//Revision of this specification	25/9/2022
8. Course Objectives	
1- The basics in the study of organic chemistry include a group of chemical groups of great importance in the field of pharmacy. These groups include aldehydes, ketones, carboxylic acids and their derivatives, amines, benzene derivatives, and phenols. It highlights their properties, nomenclature, interactions, and preparation methods. 2- Methods of qualitative detection of organic compounds are studied with the aim of examining their composition and distinguishing them. Students are also instructed to understand and follow safe and correct procedures when handling chemicals and glassware, including directions on the use of protection and	

ventilation.

3- It also sheds light on how chemical compounds are detected in various ways, allowing students to understand how to verify the presence and identify different chemical species.

4- In general, students are guided to understand the basic and applied aspects of studying organic chemistry and how to interact with chemical compounds safely and effectively.

9. Learning Outcomes, Teaching, Learning and Assessment Method

A. Cognitive goals

- A1- How to deal with organic chemical compounds and their reactions.
- A2- How to deal with scientific equipment
- A3- Learning using different scientific techniques
- A4- Knowledge of the methods used in the preparation of organic compounds.

B. The skills goals special to the course

- B1- Acquisition of skill in preparing compounds and medicines
- B2- Acquisition of skill in the use of different methods in the manufacture and preparation of medicines
- B3- Acquisition of skill in how to deal with chemical compounds
- B4- Acquisition of skill in writing scientific reports

Teaching and Learning Methods

- 1- Seminars - daily assignments - written exams

Assessment methods

Oral and written exams - scientific reports

C. Affective and value goals

C 1- Enhancing students' understanding by linking theoretical aspects to practical aspects, by conducting investigations and studying the chemical and physical properties of compounds.

C 2- Enhancing students' ability to think and analyze effectively.

C3- Enhancing students' ability to work as a research team, to develop effective cooperation and interaction skills in a team environment.

C4- Enhancing students' ability to ask objective questions and participate in scientific

discussions, to stimulate the spirit of inquiry and interaction in the educational process

Teaching and Learning Methods

- Providing the student with the basics and topics related to knowledge
- Clarification and explanation of study materials by the teaching staff
- Asking students to visit the library to obtain academic knowledge
- Request reports and seminars on the topics covered

Assessment methods

1. Seminars - daily assignments - written exams

D. General and rehabilitative transferred skills (other skills relevant to employability and personal development)

1. D1- Acquire the skill of safe handling of chemicals and glassware.
2. D 2- Acquire the skill of writing scientific reports and research accurately and effectively.
3. D 3- Acquire skill in implementing chemical diagnosis methods for chemical substances.
4. D 4- Acquire skill in using books and modern educational means to achieve personal development and develop educational capabilities.

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10. Theory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1.	3	1A,2A,3A,1B,3B,4B,1C,2C,3C,4C,1D,2D, ,4D	An introduction	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam 4- Final exam
2.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Alkanes and methane		
3.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Alkanes and methane		
4.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Alkenes 1 and 2		
5.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Alkenes 1 and 2		
6.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Alkynes and Dienes		
7.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Alkynes and Dienes		
8.	3	1A,2A,3A,4A,1B,2B,3B,1C,2C,3C,4C,1D, ,3D,4D	Stereochemistry 1		
9.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Stereochemistry 1		
10-11	6	2A,3A,4A,1B,2B,3B,1C,2C,3C,4C,1D,2D ,4D	Alcohols		
12	3	1A,2A ,4A,1B,2B,3B,4B,1C,3C,4C,1D,2D,3D,4D	Ether		
13-14	6	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Alkyl halides		
15	3	1A,2A,3A,1B,2B,3B,4B,1C,2C,3C,4C,1D ,3D,4D	Cyclic alkenes		

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10. Laboratory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Demonstration of some laboratory equipment	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam 4- Final exam
2.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Melting point		
3.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	unknown		
4.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Boiling point		
5.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	unknown		
6.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Elemental analysis		
7.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	unknown		
8.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Filtration		
9.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Recrystallization		
10.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	unknown		
11.	2	1A,2A,3A,4A,1B,2B,3B,2C,3C,4C,1D,2D,4D	Extraction		
12.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Extraction		
13.	2	1A,2A,3A,4A,3B,4B,1C,2C,3C,1D,2D,3D,4D	Distillation		
14.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D	Sublimation		
15.			Exam		

11. Infrastructure	
Books Required reading	Organic Chemistry by Robert T. Morrison and Robert N. Boyd · Organic Chemistry by McCurry; 9th ed. Thomson learning; CA,USA; 2015
Main references (sources)	Organic Chemistry by Robert T. Morrison and Robert N. Boyd · Organic Chemistry by McCurry; 9th ed. Thomson learning; CA,USA; 2015
Recommended books and references (scientific journals, reports...).	Scientific journals
Electronic references, Internet sites...	Web sites of Universities

12. Course development plan

Developing academic curricula to suit the development in the chemical structures of medicines and training students to work in chemical laboratories and use chemical reactions in the manufacture of medicines with active groups.

Al-Ayen University

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COURSE SPECIFICATION

This academic description outlines the exploration of foundational principles in organic chemistry crucial for understanding pharmacy. It involves scrutinizing organic chemical structures and functional groups, including aldehydes, ketones, and heterocyclic compounds, emphasizing their definition, properties, nomenclature, and interactions, particularly in relation to pharmaceutical compounds. Additionally, it encompasses the study of qualitative analysis methods employed for identifying functional groups in organic compounds.

1. Educational institution	Al-Ayen University - College of Pharmacy
2. College department/Center	Pharmaceutical chemistry
3. Course title/code	Organic Chemistry II PH2101
4. Modes of Attendance offered	Full-time and official attendance hours
5. Semester/Year	First semester 2022-2023
6. Credits (total)	45 hrs+30 hrs practical
7. Date of description form preparation//Revision of this specification	25/9/2022
8. Course Objectives	
1- Examining the concepts and foundations of organic chemistry that establish the understanding of the principles of pharmacy 2- Study of organic chemical structures and functional groups (such as: aldehydes, ketones, carboxylic acids, carboxylamine derivatives, nitriles, and other nitrogenous organic compounds, heterocyclic compounds, and carbohydrates), so that the focus is on analyzing their definition, structure, properties, and chemical nomenclature, And the interactions in which it participates, and the relationship between it and some pharmaceutical compounds. 3- Study the analysis methods that are used for qualitative discovery in organic compounds (analysis of functional groups in organic compounds).	

9. Learning Outcomes, Teaching, Learning and Assessment Method

A-Cognitive goals

- 1- How to deal with organic chemical compounds and their interactions.
- 2- How to deal with scientific devices.
- 3- Learn to use different scientific techniques.
- 4- Knowing the methods used to prepare organic compounds.

B-The skills goals special to the course

- 1 - Equalization of skill in preparing vehicles and medicines
- 2 - Gain skill in using different methods in manufacturing and preparing medicines
- 3 - Gain skill in how to deal with chemical compounds
- 4- Gain skill in writing scientific reports.

Teaching and Learning Methods

Seminars - daily assignments - written exams

Assessment methods

- 1- Short MCQs
- 2- Oral exam and direct questions in the class
- 3- Midterm exam
- 4- Electronic exams on the electronic platform
- 5- Final exam

C-Affective and value goals

C 1- Enhancing students' understanding by linking theoretical aspects to practical aspects, by conducting investigations and studying the chemical and physical properties of compounds.

C 2- Enhancing students' ability to think and analyze effectively.

C3- Enhancing students' ability to work as a research team, to develop effective cooperation and interaction skills in a team environment.

C4- Enhancing students' ability to ask objective questions and participate in scientific discussions, to stimulate the spirit of inquiry and interaction in the educational process.

Teaching and Learning Methods

- Providing the student with the basics and topics related to knowledge
- Clarification and explanation of study materials by the teaching staff
- Asking students to visit the library to obtain academic knowledge
- Request reports and seminars on the topics covered

Assessment methods

Daily tests with multiple choice questions for academic subjects
Participation grades for difficult competition questions
Make reports
Daily duties

D-General and rehabilitative transferred skills (other skills relevant to employability and personal development)

D1- Acquire the skill of safe handling of chemicals and glassware.

D 2- Acquire the skill of writing scientific reports and research accurately and effectively.

D 3- Acquire skill in implementing chemical diagnosis methods for chemical substances.

D 4- Acquire skill in using books and modern educational means to achieve personal development and develop educational capabilities.

Al-Ayen University

جامعۃ العین

10. Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1-2	6	1A,2A, ,1B,2B,3B,4B,1C,2C, ,4C,1D,2D,3D,4D	Benzene and aromatic compounds	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm and final exam
3-4	6	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C, 3D,4D	Electrophilic Aromatic Substitution		
5.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Carboxylic acids		
6.	2	1A,2A,3A,4A,1B,2B,3B, ,2C,3C,4C,1D,2D,3D,4D	Functional Derivatives of Carboxylic acids		
7.	2	1A,2A,3A,4A,1B,2B,3B, ,2C,3C,4C,1D,2D,3D,4D	Functional Derivatives of Carboxylic acids		
8.	2	1A,2A,3A,4A,1B,2B, ,1C,2C,3C,4C,1D,2D,3D	Amin I		
9	3	1A,2A,3A,4A,1B,2B, ,1C,2C,3C,4C,1D,2D,3D,	Amin II		
10-11.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Aldehydes and ketones (included aldol and Claisen condensation);		
12.	3	1A,2A, ,4A,1B,2B,3B,4B,1C, ,3C,4C,1D,2D,3D,4D	Aldehydes and ketones reactions and properties		
13.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C, ,3D,4D	Phenols.		
14	3	1A,2A,3A, ,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Phenols reactions and properties		
15.	3		Final Examination		

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10. Laboratory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Solubility class	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion 3- practical experiment	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam 4- Final exam
2.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Solubility class (quiz-unknown)		
3.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Identification of Alcohols		
4.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Identification of Alcohols (quiz- unknown)		
5.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Identification of Phenols		
6.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Identification of Phenols (quiz-)unknow		
7.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Identification of Aldehydes and ketones		
8.	2		Mid Examination		
9.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Identification of Aldehydes and ketones (quiz- unknown)		
10.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Identification of Carboxylic acid		
11.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Identification of Carboxylic acid (quiz- unknown)		
12.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Identification of Amines		
13.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Identification of Salt of carboxylic acid		
14.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Identification of Salt of carboxylic acid (quiz- unknown)		
15.			Exam		

11. Infrastructure	
Books Required reading	Organic Chemistry by Robert T. Morrison and Robert N. Boyd . Organic Chemistry by McCurry; 9th ed. Thomason learning; CA,USA; 2015
Main references (sources)	Organic Chemistry by Robert T. Morrison and Robert N. Boyd . Organic Chemistry by McCurry; 9th ed. Thomason learning; CA,USA; 2015
Recommended books and references (scientific journals, reports...).	Scientific journals
Electronic references, Internet sites...	Websites of Universities

12. Course development plan

Course planning takes place in two main stages. In the first stage, course specifications are written, while the second stage focuses on preparing the course plan as a basis for comprehensively leading the educational process, both in implementation and evaluation. The main goal of this planning is to achieve effective communication between students and faculty.

This process seeks to support students in assessing their readiness for the course, and to enable them to self-regulate their learning process. In addition, the process seeks to monitor the progress of student achievement and provide a basis for evaluating the course and understanding how much students are benefiting from it.

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COURSE SPECIFICATION

Organic Chemistry III explores the classification, properties, preparation, and reactions of heterogeneous organic compounds, emphasizing heterocyclic chemistry with a focus on nitrogen, sulfur, and oxygen-containing rings crucial for pharmaceutical sciences. Specific compounds like pyrrole, furan, thiophene, pyridine, quinolines, and isoquinolines are analyzed for their properties, nomenclature, interactions, and synthesis. The curriculum also covers qualitative detection methods for compounds containing heterogeneous rings, enhancing understanding of their nature and interactions.

1. Educational institution	Al-Ayen University - College of Pharmacy
2. College department/Center	Pharmaceutical chemistry
3. Course title/code	Organic chemistry III PH 2201
4. Modes of Attendance offered	Full-time and official attendance hours
5. Semester/Year	Second semester 2022-2023
6. Credits (total)	45 hrs+ 30 hrs practical
7. Date of description form preparation//Revision of this specification	25/9/2022
8. Course Objectives	
1- In Organic Chemistry 3, we carefully examine the classification, properties, preparation, and reactions of heterogeneous organic compounds. This study highlights the fundamentals of heterocyclic chemistry, with a superior focus on some rings that include elements such as nitrogen, sulfur, and oxygen, which represent an essential basis for the study of pharmaceutical sciences. We analyze in detail specific compounds such as pyrrole, furan, thiophene and pyridine, as well as quinolines and isoquinolines, focusing on their properties, nomenclature, interactions and how to prepare them. 2- In addition, the study delves into methods for the qualitative detection of	

compounds containing heterogeneous rings, such as drugs and organic compounds, to provide a comprehensive view of the nature of these compounds and their interactions.

9. Learning Outcomes, Teaching, Learning and Assessment Method

A-Cognitive goals

A1 - Dealing with chemical compounds:

In this context, it determines how to interact with chemical compounds safely and effectively, promoting a deep understanding of chemical properties and interactions. It seeks to achieve cognitive goals related to classifying compounds, understanding reaction mechanisms, and analyzing physical and chemical properties.

A2 - Dealing with scientific equipment:

Here emphasis is placed on how to use and deal with various scientific instruments, such as measuring and spectroscopic instruments, nuclear magnetic spectroscopy, and others. This aims to develop skills in safe and accurate operation of these devices to obtain accurate and reliable data.

A3 - Learning using different scientific techniques:

This part includes how to analyze data and use different scientific techniques, such as chromatographic and spectroscopic techniques, to analyze and interpret the results. It aims to develop analytical thinking skills and sound scientific analysis.

A4 - Knowing the methods used in preparing medicines:

This point focuses on understanding the processes and methods used in preparing medicines, from the selection of raw materials to the complex chemical preparation processes. It aims to provide students with a comprehensive understanding of drug manufacturing processes and identify the important stages in these processes.

B-The skills goals special to the course

B1 - Acquiring skill in preparing compounds and medicines:

This objective aims to develop students' skills in preparing chemical compounds and drugs in efficient and accurate ways, with an emphasis on the main chemical steps and safety in handling chemicals.

B2 - Acquire skill in using different methods in manufacturing and preparing medicines:

This objective aims to guide students towards understanding and using a variety of methods and techniques in the manufacture and preparation of drugs, allowing them to effectively deal with the challenges of manufacturing organic compounds.

B3 - Acquiring skill in how to deal with chemical compounds:

This goal aims to enhance skills in dealing with chemical compounds safely and effectively, including controlling environmental conditions and using personal protective equipment.

B4 - Acquiring the skill in writing scientific reports:

This goal includes developing scientific report writing skills, including documenting experiments, analyzing data, and formulating results accurately and systematically. It aims to develop students' abilities in effective scientific expression and correctly explaining chemical relationships.

Teaching and Learning Methods

Seminars - daily assignments - written exams

Assessment methods

Oral and written exams - scientific reports

C-Affective and value goals

1C - Enhancing students' understanding by linking the theoretical aspect to the practical aspect, by conducting the detection and study of the chemical and physical properties of heterocyclic compounds, and linking this to medicines that contain these rings.

2c - Enhancing students' ability to think and deeply analyze chemical and pharmaceutical topics.

3C - Enhancing students' ability to work as a research team, which contributes to developing cooperation skills and effective interaction with colleagues.

4c - Enhancing students' ability to ask objective questions and participate in scientific discussions, which encourages effective interaction and constructive interaction within the classroom.

Teaching and Learning Methods

- Providing the student with the basics and topics related to knowledge
- Clarification and explanation of study materials by the teaching staff
- Asking students to visit the library to obtain academic knowledge
- Request reports and seminars on the topics covered

Assessment methods

Oral and written exams-scientific reports

D-General and rehabilitative transferred skills (other skills relevant to employability and personal development)

1D- Acquiring skill in dealing with chemicals and glassware, which contributes to developing safety and efficiency skills in various chemical processes.

2D - Acquiring the skill in preparing scientific reports and research in a thoughtful and systematic manner, which enhances students' abilities to express scientifically and transmit information effectively.

3D- Acquiring skill in chemical diagnosis methods for chemical substances, which enhances students' understanding of chemical analysis processes and interpretation of results.

4D - Acquiring skill in using books and modern teaching aids, which enhances students' ability to research and benefit from available sources to develop their understanding and knowledge of chemistry.

10. Theory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1-3	6	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Heterocyclic system: Classes of heterocyclic systems; general structures; properties; Occurrence in nature and in medicinal products.	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam 4- Final exam
4-6	6	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Five-membered ring heterocyclic compounds: pyrrole; furan and thiophen.		
7-8	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Electrophilic substitution in pyrrole, furan and thiophen: Reactivity and orientation.		
9-10	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Six-membered ring heterocyclic compounds: Structure of pyridine. Basicity of pyridine. Reactions of pyridine		
11-13	6	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Saturated five- membered heterocyclic compounds.		
14-15	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Saturated five- membered heterocyclic compounds.		

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10. Laboratory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Synthesis of derivatives	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam 4- Final exam
2.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Oxidation of arenes		
3.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Oxidation of arenes (quiz &unkown)		
4.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Preparation of esters		
5.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Preparation of esters(quiz &unkown)		
6.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Hydrolysis of esters		
7.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Hydrolysis of esters(quiz &unkown)		
8.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Mid Examination		
9.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Mid Examination		
10.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	(amides)		
11.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Preparation of amides		
12.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Preparation of amides (quiz-unknown)		
13.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	picric acid		
14.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Preparation of picric acid		
15.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Preparation of picric acid (quiz- unknown)		

11. Infrastructure	
Books Required reading	Organic Chemistry by Robert T. Morrison and Robert N. Boyed, latest edition. Organic Chemistry by J. McMurry, latest ed., Thomson learning, CA, USA. An introduction to the chemistry of heterocyclic compound by Acheson, R. M. latest ed.
Main references (sources)	Organic Chemistry by Robert T. Morrison and Robert N. Boyed, latest edition. Organic Chemistry by J. McMurry, latest ed., Thomson learning, CA, USA. An introduction to the chemistry of heterocyclic compound by Acheson, R. M. latest ed.
Recommended books and references (scientific journals, reports...).	Scientific journals
Electronic references, Internet sites...	Websites of Universities

12. Course development plan

Developing academic curricula to suit the development in chemical structures, adding preparation methods and reactions that keep pace with current developments, and using appropriate conditions for each reaction while ensuring quality of life and health in dealing with these reactions.

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COURSE SPECIFICATION

This course describes the understanding of the biological activity inherent in chemical structures is paramount in drug research. This involves comprehensive analysis of functional groups present in drugs and their correlation with biological effects. Familiarity with various drug classes, their preparation, and identification methods is essential for effective pharmacological investigation. Additionally, strategies to mitigate potential side effects during drug study are crucial for optimizing therapeutic outcomes and safety profiles.

1. Educational institution	Al-Ayen University - College of Pharmacy
2. College department/Center	Pharmaceutical chemistry
3. Course title/code	Inorganic Pharmaceutical Chemistry PH3101
4. Modes of Attendance offered	Full-time and official attendance hours
5. Semester/Year	First semester 2022-2023
6. Credits (total)	45 hrs+ 30 hrs practical
7. Date of description form preparation//Revision of this specification	25/9/2022
8. Course Objectives	
1- - know the biological activity , if present in chemical structure 2-study all the functional groups for the drugs 3- study the relationship between functional groups and biological activity 4-know some of drug classes including preparation and identification 5-explain how to avoid the side effects of drugs during the study	

9. Learning Outcomes, Teaching, Learning and Assessment Method

A-Cognitive goals

- 1- How to deal with chemical compounds
- 2- How to deal with scientific equipment
- 3- Learning using different scientific techniques
- 4- Knowing the methods used in preparing medicines

B-The skills goals special to the course

- 1- Acquisition of skill in preparing compounds and medicines
- 2- Acquisition of skill in the use of different methods in the manufacture and preparation of medicines
- 3- Acquisition of skill in how to deal with chemical compounds
- 4- Acquisition of skill in writing scientific reports

Teaching and Learning Methods

Seminars - daily assignments - written exams

Assessment methods

Oral and written exams - scientific reports

C-Affective and value goals

- C 1- Students will review the topics discussed in the part.
C 2- Asking questions that students are asked to solve during the classes in the section
C 3- Organizing quick intellectual exams for students in the section.
C 4- Respect and respect the opinions of colleagues while discussing topics.

Teaching and Learning Methods

- Providing the student with the basics and topics related to knowledge
- Clarification and explanation of study materials by the teaching staff
- Asking students to visit the library to obtain academic knowledge
- Request reports and seminars on the topics covered

Assessment methods

Oral and written exams-scientific reports

D-General and rehabilitative transferred skills (other skills relevant to employability and personal development)

- D1- Acquire the skill of safe handling of chemicals and glassware.
D 2- Acquire the skill of writing scientific reports and research accurately and effectively.
D 3- Acquire skill in implementing chemical diagnosis methods for chemical substances.
D 4- Acquire skill in using books and modern educational means to achieve personal development and develop educational capabilities.

10. Theory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Atomic and molecular structure/complications	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam platform 4- Final exam
2.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Atomic and molecular structure/complications		
3.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Atomic and molecular structure/complications		
4	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Atomic and molecular structure/complications		
5.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Gastrointestinal agents: Fluoride, bromide, lithium, gold, silver and mercury		
6.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Antacid		
7.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Protective adsorbents.		
8.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Topical agents		
9.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Dental agents I		
10.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Dental agents II		
11.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Radiopharmaceutica I preparations I		
12.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Radiopharmaceutica I preparations II		
13	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Radio opaque and contrast media I.		
14	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Radio opaque and contrast media II		
15		1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D			

10. Laboratory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1-2	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Preparation and standardization of 0.1N KMnO ₄ (known sample, quiz and unknown).	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam 4- Final exam
3-4	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of NaOH solution (unknown sample + known)		
5-6	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of hydrogen peroxide solution (known sample , quiz and unknown)		
7	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of ferrous sulfate (known sample And unknown sample).		
8-9	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Preparation and standardization of 0.1Na ₂ S ₂ O ₄ solution (known, quiz and unknown sample).		
10-11	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of copper sulfate (known sample, unknown sample).		
12-13	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of Chlorinated Lime (known sample, quiz and unknown).		
14-15	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Preparation and assay of Lugol's Solution (known sample, quiz and unknown).		

11. Infrastructure

Books Required reading	Inorganic Medicinal and Pharmaceutical Chemistry by Block, Roche Soine and Wilson, latest edition Wilson and Gisvold; Textbook of Organic medicinal and Pharmaceutical chemistry; Delgado JN, Remers WA, (eds); latest edition
Main references (sources)	Inorganic Medicinal and Pharmaceutical Chemistry by Block, Roche Soine and Wilson, latest edition Wilson and Gisvold; Textbook of Organic medicinal and Pharmaceutical chemistry; Delgado JN, Remers WA, (eds); latest edition
Recommended books and references (scientific journals,	Scientific journals

reports...).	
Electronic references, Internet sites...	Websites of Universities

12-Course development plan

Course planning is organized in two phases; The first includes writing course specifications, while the second aims to prepare the course plan as a basis for leading the educational process with its implementation and evaluation aspects. Planning is done with the aim of achieving effective communication between students and faculty members. This helps students assess their readiness for the course, allows them to self-adjust their learning, and monitor their progress in the course. The plan also provides a basis for students to evaluate the course and understand how much they will benefit from it.

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جامعة العين

COURSE SPECIFICATION

The Organic Pharmaceutical Chemistry course provides the study of organic structures and chemical reactions related to pharmaceutical compounds. The course includes the analysis of organic molecules and biological functional groups of drugs, in addition to studying the relationship between chemical structure and biological activity. The course also focuses on introducing students to the different classes of drugs, and their preparation and identification processes. The curriculum includes methods of preventing side effects of medications during study and how to deal with them effectively.

1. Educational institution	Al-Ayen University - College of Pharmacy
2. College department/Center	Pharmaceutical chemistry
3. Course title/code	Organic pharmaceutical chemistry I PH3201
4. Modes of Attendance offered	Full-time and official attendance hours
5. Semester/Year	Second semester 2022-2023
6. Credits (total)	45 hrs +30 hrs practical
7. Date of description form preparation//Revision of this specification	25/9/2022
8. Course Objectives	
1- Understanding the scientific foundations and basic concepts of organic chemistry and their application to pharmaceutical compounds.	
2- Explaining the importance of studying the chemical reactions of organic compounds in designing and developing drugs.	
3- Introducing students to biological functional groups and analyzing their impact on the biological activity of drugs.	
4- Providing students with the knowledge necessary to understand the manufacture, analysis and identification of drugs in various therapeutic boxes.	
5- Explaining methods of preventing potential side effects of medications and applying	

9. Learning Outcomes, Teaching, Learning and Assessment Method

A-Cognitive goals

- A1- How to deal with chemical compounds
- A2- Learning using different scientific techniques
- A3- Knowing the factors that affect the stability, solubility and absorption of drugs
- A4- Knowing the mechanism of action of the drug and the relationship of the chemical structure to that

B-The skills goals special to the course

- B1- Acquisition of skill in preparing compounds and medicines
- B2- Acquire skill in using different methods in manufacturing and preparing medicines
- B3- acquiring the skill in how to deal with chemical compounds
- B4- Gaining the skill in writing scientific reports

Teaching and Learning Methods

Seminars - daily assignments - written exams

Assessment methods

Oral and written exams - scientific reports

C-Affective and value goals

- C1- Knowing the methods of designing drugs and chemical compounds
- C2- Knowledge of methods of laboratory synthesis of drugs and chemical compounds
- C3- Learn the methods of laboratory analysis to know the composition of chemical compounds
- C4- Preparing various medicines

Teaching and Learning Methods

- Providing the student with the basics and topics related to knowledge
- Clarification and explanation of study materials by the teaching staff
- Asking students to visit the library to obtain academic knowledge
- Request reports and seminars on the topics covered

Assessment methods

Oral and written exams-scientific reports

D-General and rehabilitative transferred skills (other skills relevant to employability and personal development)

- D1- Conducting scientific experiments
- D2- Acquisition of skill in preparing medicines
- D3- Giving confidence to the student by presenting scientific research
- D4- Acquiring the skill to detect and classify drugs

strategies to improve drug safety and effectiveness.

10. Theory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Drug distribution.	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam 4- Final exam
2.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Acid- base properties.		
3.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Statistical prediction of pharmacological activity.		
4	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	QSAR models.		
5.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Molecular modeling (Computer aided drug design.)		
6	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Drug receptor interaction: force involved.		
7	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Steric features of drugs.		
8	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Optical isomerism and biological activity.Calculated conformation.		
9	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Three- dimensional quantitative structure activity relationships and databases.		
10	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Isosterism .Drugreceptor interaction and subsequent		
11	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Drug Metabolism-I		
12	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Drug Metabolism-II		
13	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Drug Metabolism-III		
14	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Drug Metabolism-IV		
15	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Factor affecting on Drug Metabolism-		

10. Laboratory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1-2	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Preparation and standardization of 1N HCl (known sample, quiz and unknown).	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam
3-4	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Preparation and standardization of 1N 1NaOH (known sample, quiz and unknown).		
5-6	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of sodium benzoate (known sample quiz and unknown).		
7-8.	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of Borax (explanation of basic concepts, quiz and unknown)		
9-10.	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of citric acid (known sample, (unknown sample).		
11-12	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of magnesium hydroxide (known sample (quiz and unknown)		
13.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of ammoniated mercury (unknown sample).		
14	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Solubilization of components of pharmaceutical preparations : Aspirin		
15	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Surface tension measurements and calculations		

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11. Infrastructure	
Books Required reading	Wilson and Gisvold Textbook of Organic medicinal and Pharmaceutical chemistry, Delgado JN, Remers WA, (Eds); 12th ed, 2011.
Main references (sources)	Wilson and Gisvold Textbook of Organic medicinal and Pharmaceutical chemistry, Delgado JN, Remers WA, (Eds); 12th ed, 2011.
Recommended books and references (scientific journals, reports...).	Scientific journals in basic specializations
Electronic references, Internet sites...	Websites of Arab and foreign universities and pharmaceutical companies

12. Course development plan

Course planning is organized in two phases; The first includes writing course specifications, while the second aims to prepare the course plan as a basis for leading the educational process with its implementation and evaluation aspects. Planning is done with the aim of achieving effective communication between students and faculty members. This helps students assess their readiness for the course, allows them to self-adjust their learning, and monitor their progress in the course. The plan also provides a basis for students to evaluate the course and understand how much they will benefit from it.

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COURSE SPECIFICATION

This course description a program of organic pharmaceutical chemistry II aims to impart comprehensive knowledge and skills essential for drug discovery and development, emphasizing the translation of synthetic formulas into effective treatments. It focuses on pharmaceutical material preparation methods while ensuring a strong foundational base for students' professional success. Additionally, the curriculum incorporates essential skills like result analysis, document interpretation, and internet utilization, preparing students for further academic pursuits and professional endeavors.

1. Educational institution	Al-Ayen University - College of Pharmacy
2. College department/Center	Pharmaceutical chemistry
3. Course title/code	Organic pharmaceutical chemistry II PH4102
4. Modes of Attendance offered	Full-time and official attendance hours
5. Semester/Year	First semester 2022-2023
6. Credits (total)	45 hrs+30 hrs practical
7. Date of description form preparation//Revision of this specification	25/9/2022
8. Course Objectives 1- The goal is to teach the student how to discover and develop new drugs to treat diseases and the ability to translate the synthetic formula of the treatment into the expected effectiveness of this treatment or drug. In addition to focusing on the methods used to prepare some pharmaceutical materials. 2- Providing a solid foundation for the student to ensure a successful professional future 3- Providing the student with some basic skills that may be necessary for future studies, such as analyzing results and documents and using the Internet.	

9. Learning Outcomes, Teaching, Learning and Assessment Method

A-Cognitive goals

A1- The study of pharmaceutical chemistry in general with regard to the discovered drugs and their relationship to the diseases they treat, along with the effect of the structural composition of those drugs on their pharmacological effectiveness.

A2- Study the metabolic pathway of some drugs and pharmaceutical drugs and methods of converting them into non-toxic, labile substances
To be excreted by the body.

A3- Study the biological effectiveness of these medications during the process of nutritional metabolism and their effect on the body.

A4- Study the structural composition of some drugs in a focused manner and know the effect of the groups that make up this compound and their relationship to the expected effectiveness of the treatment in addition to their relationship to the side effects of the treatment.

B-The skills goals special to the course

B 1. Discovering new medicines to treat various diseases.

B2. Studying the structural formula of the compound and its effect on the effectiveness of treatment.

B3.Methods of synthesis of some compounds with therapeutic efficacy.

B4. Acquire the skill of discovering and classifying drugs

Teaching and Learning Methods

Seminars - daily assignments - written exams

Assessment methods

Oral and written exams - scientific reports

C-Affective and value goals

C1- Knowing the methods of designing drugs and chemical compounds

C2- Knowledge of methods of laboratory synthesis of drugs and chemical compounds

C3- Learn the methods of laboratory analysis to know the composition of chemical compounds

C4- Preparing various medicines

Teaching and Learning Methods

-Providing the student with the basics and topics related to knowledge

-Clarification and explanation of study materials by the teaching staff

-Asking students to visit the library to obtain academic knowledge

-Request reports and seminars on the topics covered

Assessment methods

Oral and written exams

D-General and rehabilitative transferred skills (other skills relevant to employability and personal development)

D1- Conducting scientific experiments

D2- Acquisition of skill in preparing medicines

D3-Giving confidence to the student by presenting scientific research

D4- Acquisition of the skill to identify and classify medicines

10. Theory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Cholinergic agents, cholinergic receptors and their subtypes.	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion 3- Presentation of cases 4- Visual aids: Utilize visual aids such as pictures, charts, graphs, diagrams	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam 4- Final exam
2.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Cholinergic agonists; stereochemistry and structure-activity relationships (SAR);		
3.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	products; cholinesterase inhibitors.		
4	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Cholinergic Blocking Agent; Structure-activity Relationships (SAR); Solanaceous Alkaloid And Analogues.		
5.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Synthetic Cholinergic Blocking Agents and Products; Ganglionic Blocking Agents (Neuromuscular Blocking Agents).		
6.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Adrenergic agents (Adrenergic neurotransmitters); Adrenergic receptors; Drugs affecting Adrenergic neurotransmission; Sympathomimetic agents; Products.		
7.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Sympathomimetic agents; Adrenergic receptor antagonists		
8.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	CNS depressant; Benzodiazepines and related compounds;		

9.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Barbiturates; CNS depressant with skeletal muscle relaxant properties; Antipsycotics; Anticonvulsants.		
10.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Central Nervous system Stimulants: 1. Analeptics 2. Methylxanthines 3. Central sympathomimetic agents (Psychomotor stimulants) Structure activity relationship		
11.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	4. Antidepressants : 1. Monoamine Oxidase Inhibitors 2. Monoamine Reuptake Inhibitors 3. Selective Serotonin Reuptake Inhibitors 4. Selective Norepinephrine Reuptake Inhibitors		
12.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Analgesic agents (SAR of morphine, SAR of meperidine type molecules; SAR of methadone type compounds; Nmethylbezomorphans, antagonist type analgesics in benzomorphans).		
13.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Analgesic receptors, endogenous opioids; Products; Antitusive agents		
14.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Nonsteroidal Anti Inflammatory Drugs (NSAIDs)		
15.		1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Steroidal and nonsteroidal hormones		

10. Laboratory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Preparation of salicylic acid.	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion 3- Presentation of cases	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam 4- Final exam
2	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Re-crystallization of salicylic acid.		
3	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Synthesis of aspirin.		
4	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Re-crystallization of aspirin.		
5	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of aspirin (known sample).		
6	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of aspirin (unknown sample).		
7	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Preparation of nitrobenzene.		
8	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Preparation of aniline.		
9	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Preparation of acetanilide.		
10	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Re-crystallization of acetanilide.		
11	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Chlorosulfonation of acetanilide.		
12	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Amination of pchlorobenzene sulfonyl chloride.		
13	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Hydrolysis of pchlorobenzene sulfonyl chloride to sulfanilamide.		
14	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of sulfa drugs (known sample).		
15	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of sulfa drugs (unknown sample).		

11. Infrastructure	
Books Required reading	Wilson and Gisvold Textbook of Organic medicinal and Pharmaceutical chemistry, Delgado JN, Remers WA, (Eds); 12th ed, 2011.
Main references (sources)	Wilson and Gisvold Textbook of Organic medicinal and Pharmaceutical chemistry, Delgado JN, Remers WA, (Eds); 12th ed, 2011
Recommended books and references (scientific journals, reports...).	The Organic Chemistry Of Drug Synthesis latest edition
Electronic references, Internet sites...	Website of Arabic and foreign universities

12. Course development plan

- Continuous updating of the curriculum prescribed for students to serve the educational process
- Maintaining scientific sobriety through the use of valuable sources and international books

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COURSE SPECIFICATION

The Organic Pharmaceutical Chemistry III course provides students advanced in pharmacy studies with a deep understanding of the basic concepts and advanced applications in organic chemistry relevant to the pharmaceutical industry. The course covers advanced topics such as modern methods for manufacturing organic pharmaceutical compounds and advanced chemical analysis of those compounds. The course also focuses on organic reactions relevant to drug design and development, and encourages students to use modern technologies in pharmaceutical laboratories. The course aims to develop students' skills in advanced chemical analysis and understanding of drug manufacturing processes, enabling them to contribute to the pharmaceutical industry in an effective and sustainable way.

1. Educational institution	Al-Ayen University - College of Pharmacy
2. College department/Center	Pharmaceutical chemistry
3. Course title/code	Organic pharmaceutical chemistry III PH4202
4. Modes of Attendance offered	Full-time and official attendance hours
5. Semester/Year	Second semester 2022-2023
6. Credits (total)	45 hrs+30 hrs practical
7. Date of description form preparation//Revision of this specification	25/9/2022
8. Course Objectives	
1- The goal is to teach the student how to discover and develop new drugs to treat diseases and the ability to translate the synthetic formula of the treatment into the expected effectiveness of this treatment or drug. In addition to focusing on the methods used to prepare some pharmaceutical materials.	
2- Providing a solid foundation for the student to ensure a successful professional	

future

3- Providing the student with some basic skills that may be necessary for future studies, such as analyzing results and documents and using the Internet.

9. Learning Outcomes, Teaching, Learning and Assessment Method

A-Cognitive goals

A1- The study of pharmaceutical chemistry in general with regard to the discovered drugs and their relationship to the diseases they treat, along with the effect of the structural composition of those drugs on their pharmacological effectiveness.

A2- Study the metabolic pathway of some drugs and pharmaceutical drugs and methods of converting them into non-toxic, labile substances To be excreted by the body.

A3- Study the biological effectiveness of these medications during the process of nutritional metabolism and their effect on the body.

A4- Study the structural composition of some drugs in a focused manner and know the effect of the groups that make up this compound and their relationship to the expected effectiveness of the treatment in addition to their relationship to the side effects of the treatment.

B-The skills goals special to the course

B1-Acquisition of skill in preparing compounds and medicines

B2-Acquire skill in using different methods in manufacturing and preparing medicines

B3-Acquiring the skill in how to deal with chemical compounds

B4- Gaining the skill in writing scientific reports

Teaching and Learning Methods

Seminars - daily assignments - written exams

Assessment methods

Oral and written exams - scientific reports

C-Affective and value goals

C1- Knowing the methods of designing drugs and chemical compounds

C2- Knowledge of methods of laboratory synthesis of drugs and chemical compounds

C3- Learn the methods of laboratory analysis to know the composition of chemical compounds

C4- Preparing various medicines

Teaching and Learning Methods

-Providing the student with the basics and topics related to knowledge

-Clarification and explanation of study materials by the teaching staff

-Asking students to visit the library to obtain academic knowledge

-Request reports and seminars on the topics covered

Assessment methods

Oral and written exams

D-General and rehabilitative transferred skills (other skills relevant to employability and personal development)

D1- Conducting scientific experiments

D2- Acquisition of skill in preparing medicines
D3- Giving confidence to the student by presenting scientific research
D4- Acquisition of the skill to identify and classify medicines



10. Theory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	β -Lactam antibiotics (Penicillins); Mechanism of action of Penicillins; Development of <i>Beta</i> lactam; SAR; Reactions of Penicillins with Electrophiles	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam 4- Final exam
2	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Broad spectrum penicillins; Reactions of Penicillins with Nucleophiles; Reactions of Penicillins with Electrophiles; Acid sensitivity of penicillins		
3	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Bioavailability: Acid Stability of Penicillins; Penicillins: Oral & Broad Spectrum Activity; The mode of Bacterial resistance; $\square$ -Lactamases inhibitors; Clavulanic acid.		
4	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Cephalosporins; Cephalosporins Functional groups (Pharmacophore); SAR of Cephalosporins; Mechanism of inhibiting transpeptidase (PBP); Mechanism of action of cephalosporin		
5	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	First generation cephalosporins; Second generation cephalosporins; 3 rd generation cephalosporins; 4th Generation cephalosporins; 5th generation		

			cephalosporin; Carbapenems ; Monobactams		
6	3	1A,2A,3A,4A,1B,2B,3B ,4B,1C,2C,3C,4C,1D,2D ,3D,4D	Antibacterial Sulfonamides (Sulfa Drugs); (chemistry, nomenclature, mechanism of action, resistance, toxicity, side effects, metabolism, protein binding, distribution and SAR).		
7	3	1A,2A,3A,4A,1B,2B,3B ,4B,1C,2C,3C,4C,1D,2D ,3D,4D	Sulfonamides; products; Sulfones.		
8	3	1A,2A,3A,4A,1B,2B,3B ,4B,1C,2C,3C,4C,1D,2D ,3D,4D	Aminoglycosides; Chemistry of Aminoglycoside; SAR of aminoglycosides; products; Tetracyclines.		
9	3	1A,2A,3A,4A,1B,2B,3B ,4B,1C,2C,3C,4C,1D,2D ,3D,4D	Macrolides, Lincosamine, chloramphenicol and Quinolones		
10	3	1A,2A,3A,4A,1B,2B,3B ,4B,1C,2C,3C,4C,1D,2D ,3D,4D	Antiviral agents (properties of viruses, viral classification, products).		
11	3	1A,2A,3A,4A,1B,2B,3B ,4B,1C,2C,3C,4C,1D,2D ,3D,4D	Antineoplastic agents (Alkylating Agents)		
12	3	1A,2A,3A,4A,1B,2B,3B ,4B,1C,2C,3C,4C,1D,2D ,3D,4D	Antineoplastic agents (Antimetabolites)		
13	3	1A,2A,3A,4A,1B,2B,3B ,4B,1C,2C,3C,4C,1D,2D ,3D,4D	Anticancer Antibiotics (Plant products)		
14	3	1A,2A,3A,4A,1B,2B,3B ,4B,1C,2C,3C,4C,1D,2D ,3D,4D	Anticancer Antibiotics (Protein kinase inhibitors, Miscellaneous)		
15	3	1A,2A,3A,4A,1B,2B,3B ,4B,1C,2C,3C,4C,1D,2D ,3D,4D	Hormones and related compounds; Future antineoplastic agents; Monoclonal antibodies; Gene therapy of cancer.		

10. Laboratory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Cannizaro reaction (part I).	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam 4- Final exam
2	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Cannizaro reaction (part II).		
3	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Re-crystallization of benzoic acid.		
4.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of ascorbic acid (known sample).		
5.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of ascorbic acid (unknown sample).		
6-7	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Synthesis of Phenol.		
8	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of phenol (known sample)		
9-10	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Assay of phenol (unknown sample).		
11-12	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Synthesis of chlorbutanol.		
13-14	4	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Synthesis of paracetamol.		
15			Final exam		

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11. Infrastructure	
Books Required reading	Wilson and Gisvold Textbook of Organic medicinal and Pharmaceutical chemistry, Delgado JN, Remers WA, (Eds); 12th ed, 2011
Main references (sources)	Wilson and Gisvold Textbook of Organic medicinal and Pharmaceutical chemistry, Delgado JN, Remers WA, (Eds); 12th ed, 2011
Recommended books and references (scientific journals, reports...).	The Organic Chemistry Of Drug Synthesis
Electronic references, Internet sites...	Websites of Arabic and foreign universities

12. Course development plan

- Continuous updating of the curriculum prescribed for students to serve the educational process
- Maintaining scientific sobriety through the use of valuable sources and international books

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COURSE SPECIFICATION

The Organic Pharmaceutical Chemistry 4 course provides students with a deep understanding of the fundamentals and principles related to pharmaceuticals. The course includes studying the physical, chemical, and pharmaceutical properties of drugs, including dose factors and drug release. It also encompasses controlling the quality of drugs and techniques for their preparation, understanding the primary characteristics of prodrugs, their metabolism mechanisms, and elimination from the body, including chemical degradation and biological reactions. Additionally, the course explores the use of computational tools in drug design, including analyzing chemical data and predicting drug effects, with the aim of improving pharmaceutical design and analysis processes effectively.

1. Educational institution	Al-Ayen University - College of Pharmacy
2. College department/Center	Pharmaceutical chemistry
3. Course title/code	Organic pharmaceutical chemistry IV PH5101
4. Modes of Attendance offered	Full-time and official attendance hours
5. Semester/Year	First semester 2022-2023
6. Credits (total)	45 hrs
7. Date of description form preparation//Revision of this specification	25/9/2022
8. Course Objectives	
Objectives of the Organic Pharmaceutical Chemistry 4 course include:	
1- Study drug introductions and understand their physical, chemical and pharmaceutical properties, including factors that affect dose selection and drug release.	
2- Learn techniques for preparing drugs and controlling their quality, including the pharmaceutical composition of the drug and the factors that affect its transport and absorption in the body.	
3- Studying the primary properties of the drug and how it is metabolized and excreted from the body, including the chemical decomposition processes and biological	

reactions that the drug undergoes inside the body.

4- Exploring the uses of automated computing in drug design, including the use of pharmaceutical software to analyze chemical data, predict drug effects, and improve drug design and analysis processes.

9. Learning Outcomes, Teaching, Learning and Assessment Method

A-Cognitive goals

A-1- Statement of knowledge and basic principles in chemistry

A-2 Conducting practical experiments on theoretical concepts

A-3 Preparing illustrative means

A- 4 Preparing brief reports

B-The skills goals special to the course

B1- Acquisition of skill in preparing compounds and medicines

B2- Acquiring the skill in using different methods in the manufacture and preparation of medicines

B3- Acquisition of skill in how to deal with chemical compounds

B4- Gaining the skill in writing scientific reports

Teaching and Learning Methods

Seminars - daily assignments - written exams

Assessment methods

Oral and written exams - scientific reports

C-Affective and value goals

C1- Knowing the methods of designing drugs and chemical compounds

C2- Knowledge of methods of laboratory synthesis of drugs and chemical compounds

C3 - Learn the methods of laboratory analysis to know the composition of chemical compounds

C4- Preparing various medicines

Teaching and Learning Methods

-Providing the student with the basics and topics related to knowledge

-Clarification and explanation of study materials by the teaching staff

-Asking students to visit the library to obtain academic knowledge

-Request reports and seminars on the topics covered

Assessment methods

Oral and written exams - scientific reports

D-General and rehabilitative transferred skills (other skills relevant to employability and personal development)

D1- Conducting scientific experiments

D2- Acquisition of skill in preparing medicines

D3-Giving confidence to the student by presenting scientific research

D4- Acquisition of the skill to identify and classify medicines

10. Theory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1-3	6	1A,2A, ,1B,2B,3B, ,2C,3C,4C,1D,2D,3D,4D	Basic concept of prodrugs; Covalent bonds (cleavable); Prodrugs of functional groups; Types of prodrugs.	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam 4- Final exam
4-6	6	1A,2A,3A,4A,1B,2B, ,4B,1C,2C,3C,4C,1D, 4D	Chemical delivery systems; Polymeric prodrugs; Types and structure of polymers; Cross-linking reagents.		
7-8.	4	1A, ,4A,1B,2B, 4B,1C,2C,3C,4C,1D, ,3D,4D	Drug targeting.		
9	2	1A,2A,3A,4A,1B,2B,3B,4B, 1C,2C,3C,4C,1D,2D,3D,4D	Project.		
10-12	6	1A, 3A,4A,1B,2B,3B,4B,1C ,4C,1D,2D,3D,4D	Combinatorial chemistry; Peptides and other linear structures; Drug like molecules; Support and linker; Solution-phase combinatorial chemistry		
13-15	6	1A,2A,3A,4A, ,3B,4B,1C,2C, ,1D,2D,3D,4D	High-throughput screening; Virtual screening; Chemical diversity and library design		

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11. Infrastructure	
Books Required reading	Wilson and Gisvold Textbook of Organic medicinal and Pharmaceutical chemistry, Delgado JN, Remers WA, (Eds); 10th ed,
Main references (sources)	Wilson and Gisvold Textbook of Organic medicinal and Pharmaceutical chemistry, Delgado JN, Remers WA, (Eds); 10th ed,
Recommended books and references (scientific journals, reports...).	Scientific journals in basic specializations
Electronic references, Internet sites...	Websites of Arab and foreign universities and pharmaceutical companies

12. Course development plan

Developing curricula to suit the development in the chemical structures of medicines and changing the active groups to obtain chemical compounds with advanced therapeutic effectiveness and study their chemical properties.

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COURSE SPECIFICATION

The Advanced Pharmaceutical Analysis course offers students an in-depth and advanced study in the concepts and techniques related to the analysis of drugs and pharmaceutical compounds. The course covers advanced chemical analysis techniques such as visible and invisible spectroscopy, chromatography-mass spectrometry (LC-MS), nuclear magnetic resonance (NMR), and CHN analysis and IR in addition to other spectroscopic methods. The course focuses on applying these techniques to the analysis of various types of pharmaceutical compounds, including solid, liquid, and biological drugs. The course also includes studying the basic principles of compound analysis and pharmaceutical quality, as well as the use of software for pharmaceutical analysis and interpretation of data resulting from the analyses. The course aims to provide students with the practical and theoretical skills necessary to analyze drugs and evaluate their quality in an accurate and effective manner.

1. Educational institution	Al-Ayen University - College of Pharmacy
2. College department/Center	Pharmaceutical chemistry
3. Course title/code	Advance pharmaceutical chemistry PH5204
4. Modes of Attendance offered	Full-time and official attendance hours
5. Semester/Year	Second semester 2022-2023
6. Credits (total)	45 hrs+ 30 hrs practical
7. Date of description form preparation//Revision of this specification	25/9/2022
8. Course Objectives	
1- Identify the different types of spectrum: This includes learning about common spectra such as ultraviolet and visible (UV-Vis), infrared (IR), nuclear magnetic resonance (NMR), and mass spectrometry. This aims to understand the spectral ranges and what information can be extracted from each species.	

2- Uses of spectrum in identifying organic compounds:

Students learn how to use different spectra to determine the identities of organic compounds. For example, UV-Vis spectroscopy can be used to determine absorbed colors that may correlate with the composition of a compound. While the NMR spectrum gives information about the relative distribution of atoms in the compound.

3- Training on practical methods for various spectrum measurements:

Students are trained in the use of various devices and techniques used in spectrometer measurements. This includes interacting with the device and adjusting conditions to obtain accurate data and correct readings.

These points contribute to developing a deep understanding of the principles of spectroscopy and how to analyze the resulting data to identify and define organic compounds.

9. Learning Outcomes, Teaching, Learning and Assessment Method

A-Cognitive goals

1A - The use of the ultraviolet spectrum in diagnosing organic and pharmaceutical compounds, including detecting double bonds, determining the arrangement and type of bonds, and the presence of active groups, chromophores, and oxochromes in molecules.

2A- The use of infrared spectrum in the diagnosis of organic and medicinal compounds, specifying the type of active and substituting groups and the effect of influencing factors. This includes knowledge of active group adsorption zones and their applications in organic chemistry.

3A- Using nuclear magnetic resonance spectroscopy to diagnose organic and pharmaceutical compounds, by studying protons and ^{13}C products to accurately determine the chemical structure.

4A - The use of mass spectrometry in the diagnosis of organic and pharmaceutical compounds, as it determines the molecular weight and contributes to the identification of isotopes and active groups.

B-The skills goals special to the course

1B - Knowing the formulas of some unknown organic compounds through analyzing their spectra, which contributes to developing the skills of interpreting spectral data and determining the molecular structure.

2B - Acquiring the skill in identifying active groups in chemical and pharmaceutical compounds, by examining and analyzing spectra to determine chemical and molecular bonds.

3B - Acquire the skill to deduce the conditions affecting the substituted groups, whether they attract or repel electrons, and understand their effect on the chemical properties of the compound.

4B - Acquire the skill in linking the results extracted from the application of various spectroscopic techniques, analyzing data to understand chemical reactions, and writing practical reports that explain the results accurately and systematically.

Teaching and Learning Methods

Seminars - daily assignments - written exams

Assessment methods

Oral and written exams - scientific reports

C-Affective and value goals

C1- Asking questions about topics that can be discussed by students -

C2: Asking questions that the student solves for the classroom -

C 3 Conduct quick intellectual exams

C 4- Identifying drug analyses

Teaching and Learning Methods

Providing the student with the basics and topics related to knowledge

Clarification and explanation of study materials by the teaching staff

Asking students to visit the library to obtain academic knowledge

Request reports and seminars on the topics covered

Assessment methods

Seminars - daily assignments - written exams

D-General and rehabilitative transferred skills (other skills relevant to employability and personal development)

D- 1 - Follow up on external sources

D-2 Preparing external questions from these sources -

D-3 Urging students to follow educational sequences

D-4 How to identify the chemical compounds of drugs through pharmaceutical analyses

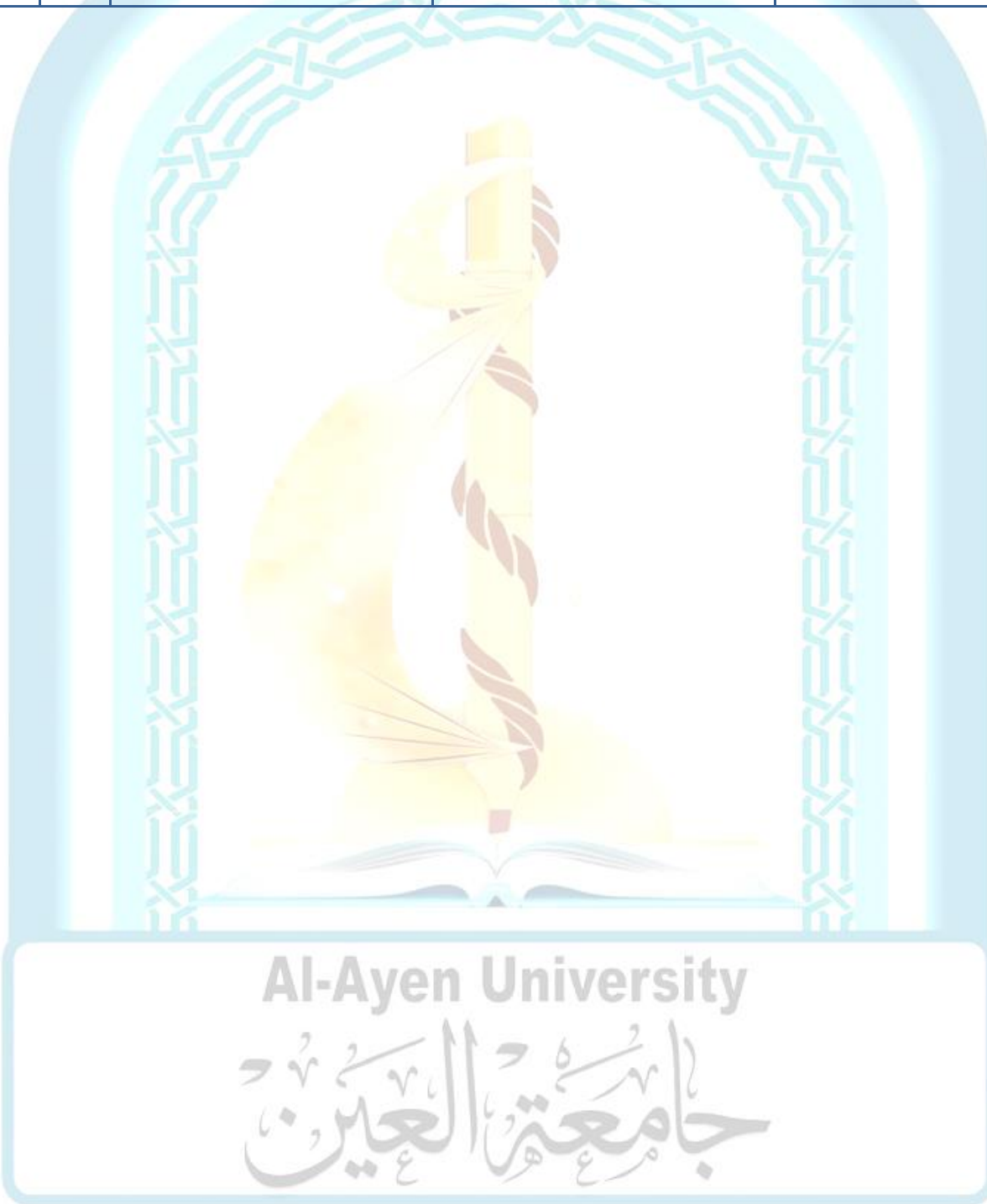
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10. Theory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	UV / visible spectroscopy; Sample handling and Characteristic instrumentation; absorption of organic compounds;	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam 4- Final exam
2.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Rules for calculation of lambda max and application; Application of UV/visible; spectroscopy;		
3.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Infra Red spectroscopy)theory bonding effect		
4.	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Sampling techniques and interpretation of spectra; Characteristic group frequencies of organic compounds.		
5	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Application of IR spectroscopy; Problems and solutions.		
6-8	9	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Introduction, the nature of NMR absorption, chemical shifts and factors affecting them.		
9-11	9	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Information obtained from NMR spin -spectra, more complex spin splitting patterns, application of ¹ H NMR Spectroscopy		
12	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	¹³ C NMR Spectroscopy, introduction and characteristics DEPT ¹³ C NMR Spectroscopy		
13	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Introduction and interpreting Mass spectra		
14	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Interpreting Mass spectra fragmentation patterns,		

			Mass behavior of some common functional groups.	
15	3	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Applications of mass spectroscopy for pharmaceutical analysis. CHN	



10. Laboratory Course Structure

Week	Hrs	ILOs	Unit/Module or Topic Title	Teaching methods	Assessment methods
1	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Introduction & demonstration to visible spectrophotometry.	1- Whiteboard and PowerPoint and data show presentation 2- Class discussion	1- Short MCQs 2- Oral exam and direct questions in the class 3- Midterm exam 4- Final exam
2	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Absorption spectra of known colored solution.		
3	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Absorption spectra of unknown colored solution.		
4.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Beer's law plot of known solution.		
5.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Beer's law plot of unknown solution.		
6.			Mid Examination		
7.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Colorimetric assay of tetracycline (FeCl ₃), known sample. Colorimetric assay of tetracycline (FeCl ₃), unknown sample		
8.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Colorimetric assay of tetracycline (acid), known sample.		
9.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Colorimetric assay of tetracycline (acid), unknown sample.		
10	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Colorimetric assay of streptomycin (maltol, known sample).		
11	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Colorimetric assay of streptomycin (maltol, unknown sample).		

12	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Colorimetric assay of streptomycin (oxidized, known sample).		
13	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Colorimetric assay of streptomycin (oxidized, unknown sample). Colorimetric assay of tetracycline (basic, known sample).		
14.	2	1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Colorimetric assay of tetracycline (basic unknown sample).		
15.		1A,2A,3A,4A,1B,2B,3B,4B,1C,2C,3C,4C,1D,2D,3D,4D	Final Exam		

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جامعۃ العین

11. Infrastructure	
Books Required reading	Spectrometric Identification of Organic Compounds by Silverstein, Bassler and Morrill ,2005. Organic Chemistry by McMurry; 7thed;Thomason learning CA, USA 2008..
Main references (sources)	Spectrometric Identification of Organic Compounds by Silverstein, Bassler and Morrill ,2005 Modern Pharmaceutical Drug Analysis, by L Zechmeister And L. Von Chohnoky, ISBN (13) : 978-81-224-2718-9 2. Pharmaceutical Analysis Edited by DAVID C. LEE GlaxoSmithKline Stevenage, UK and MICHAEL L. WEBB GI
Recommended books and references (scientific journals, reports...).	Scientific journals in basic specializations
Electronic references, Internet sites...	WEBSITE of universities

12. Course development plan

Developing curricula to suit the development in the chemical structures of drugs and changing the active groups to obtain chemical compounds with advanced therapeutic efficacy and studying their chemical properties, integrating modern topics and practical applications. Encouraging discussions and research projects.
Provide additional learning resources and create online resources to provide information. Workshops and training courses.