وزارة التعليم العالي والبحث العلمي
جـــهاز الإشـــراف والتقـويم العلـمي
دائرة ضمان الجودة والاعتماد الأكاديمي

استمارة وصف البرنامج الأكاديمي للكليات والمعاهد

للعام الدراسي 2022-2023

الجامعة : بغداد

الكلية /المعهد : العلوم

القسم العلمي : الكيمياء

تاريخ ملىء الملف : 2022/10/1

التوقيع :

اسم رئيس القسم : أ.م.د. ندى مطير عباس

التاريخ :1/10/2022

التوقيع :

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التاريخ :1/10/2022

دقق الملف من قبل

شعبة ضمان الجودة والأداء الجامعي

اسم مدير شعبة ضمان الجودة والأداء الجامعي: أ.د. اسراء علي زيدان

التاريخ / /

التوقيع

مصادقة السيد العميد

أ.د. عبد الكريم عبد الله

The graduate program grants a PhD in one of the chemical specializations after completing two courses of 15 weeks and three hours for each course (mandatory and optional) in both courses, passing the comprehensive exam, and submitting and discussing the doctoral thesis by a specialized scientific committee, noting that the number of course units is 26 units and the number of thesis units is 34 units. The course description includes the following five chemistry specializations:

1- Physical Chemistry.
2- Organic Chemistry.
3- Inorganic Chemistry.
4- Analytical Chemistry.
5- Biochemistry.

University of Baghdad	1. Educational Institution
College of Science/Department of Chemistry	2. Academic Department/Center
Academic Program for Doctoral Studies in the Department of Chemistry	3. Name of Academic or Professional Program
PhD in Chemistry Sciences (Specialization)	4. Name of Final Certificate
Semester	5. Study System:
None	Annual/Courses/Other
Internet, Seminars, PowerPoint Presentation	6. Accredited Accreditation Program
2022/9/1	7. Other External Influences

Academic Program Objectives

1- Preparing highly skilled researchers in various chemistry specializations to provide universities, research and educational institutions and other ministries with qualified scientific cadres that keep pace with scientific progress in the world.

2- Keeping pace with developments in curricula, openness and communication with similar scientific institutions inside and outside the country, and keeping pace with the era of development through modern electronic systems.

3- Contributing to enriching human knowledge through specialized studies and serious scientific research to reach innovative scientific and applied additions, and revealing new facts.

4- Encouraging scientific competencies to keep pace with the rapid progress of science and technology and pushing them to creativity and innovation and developing scientific research and directing it to address what serves society and increasing the college's ability in sustainable development and serving society.
5- The Chemistry Department should be a model that seeks to achieve a solid scientific level and prepare competent scientists who possess scientific backgrounds and chemical or research skills that enable them to practice their work safely and effectively, and are prepared to keep pace with cognitive and technical progress and strive to obtain higher degrees in various chemical specialties, and contribute to preparing future leaders in scientific and educational fields. Through: striving to meet international standards and requirements for quality and academic accreditation and achieving globality in the quality of educational programs and services provided by the college and competing to advance on international classification lists. Drawing a roadmap for the purpose of improving educational quality and scientific activities within the college and developing programs and plans with a future vision.
6- Introducing modern educational methods and advanced technologies in teaching methods and preparing high-level educational programs and employing information and communication technologies in the process of transferring and producing knowledge, scientific research and in preparing curricula for educational programs.
7- Activating the scientific research movement and creating an appropriate climate for creativity and invention.
8- Providing faculty members capable in terms of efficiency and number to implement the mission of the college and the department.

9- Providing a supportive organizational climate and academic environment.
10- Employing scientific research in serving the country's social and developmental issues.
11- Activating participation, coordination and integration between the college, the department and the community by holding seminars, conferences and seminars to discuss the country's health and scientific issues.
12- Contributing to the transfer and production of knowledge and the requirements of building the national system for science and technology through effective participation in seminars, seminars and local, Arab, international or global conferences.

1. Required program outputs and teaching, learning and evaluation methods
A-A Cognitive objectives.
A1- Enabling students to obtain knowledge and understanding of chemistry in all its precise specializations.
A2- Enabling students to obtain knowledge and understanding of the chemical structures of compounds.
A3- - Enabling students to obtain knowledge and understanding of the mechanics of chemical reactions and methods of detection and diagnosis.
A4- Enabling students to gain knowledge and understanding of practical experiments.
A5- Seeking to prepare scientists and researchers with scientific and laboratory skills of a research nature.

A5- Providing educational programs that keep pace with technical development and conducting solid scientific research and studies.
A6- Interacting with scientific and technical experiments and expertise in a manner that serves society.
A7- Establishing research projects that provide solutions to society's problems.

B- Program specific skill objectives:
B1- Providing students with the special skills to know the problems that society suffers from, their causes, how they are distributed and the impact of various factors on them, and knowing the most appropriate ways and means to solve these problems.
B2- Providing students with the basic skills to conduct various scientific studies.
B3- The graduate acquires the knowledge and research skills necessary for his academic and professional future.
B4- Graduates of this program are prepared either for academic professions or practical professions in other ministries outside of higher education.

Teaching and learning methods

1- Lecture method and use of interactive whiteboard.
2- Explanation and clarification.
3- Providing students with the basics and additional topics related to the outputs of thinking and chemical analysis for various chemical specializations.
4- Forming discussion groups during lectures to discuss chemistry topics that require thinking and analysis.
5- Asking students a set of mental questions during lectures such as what, how, when and why for specific topics.
6- Giving students homework that requires self-explanations in causal ways.

Evaluation methods

1- Research evaluation
2- Theoretical tests.
3- Reports and studies.
4- Daily exams with self-solved questions.
5- Specific grades for homework.
6- Final exam.
7- Comprehensive exam.

C- Emotional and value-based objectives:
C1- Enabling students to understand chemistry in all specializations.
C2- Enabling students to solve problems related to the analysis, diagnosis and discrimination of chemical compounds.
C3- Enabling students to solve problems related to the intellectual framework of chemistry.
C4- Acquiring the skill of ethical dealing with participants in scientific research.
C5- Creating scientific competencies characterized by professionalism, transparency, honesty and integrity.

Teaching and learning methods

1- Lecture method and use of interactive whiteboard.

2- Explanation and clarification.
3- Providing students with the basics and additional topics related to the outputs of thinking and chemical analysis.
4- Forming discussion groups during lectures to discuss chemistry topics that require thinking and analysis.
5- Asking students a set of mental questions during lectures such as what, how, when and why for specific topics.
6- Giving students homework that requires self-explanations in causal ways.
Evaluation methods
1- Evaluating the student's performance during the lecture.
2- Evaluating the student's performance during the field research as part of the practical evaluation.
3- Short exams during the semester.
4- Theoretical evaluation exam for the middle and end of the semester.
5- Comprehensive exam.
6- Scientific discussion of the doctoral student's thesis.

D- General and transferable qualification skills (other skills related to employability and personal development).
D1- Preparing a holder of a higher degree with high mental ability so that he is confident and a decision-maker.
D2- Mastering the basic skills for practicing scientific research theoretically and practically in theoretical chemistry.
D3- Writing and evaluating technical reports and scientific papers in a professional manner in the field of theoretical chemistry.
D4- Evaluating research-based methods, tools and equipment used in chemistry in all specializations.
D5- Applying the analytical approach and using it in the field of theoretical chemistry.
D6- Applying specialized knowledge in theoretical chemistry and integrating it with related knowledge in his professional practice.
D7- Making optimal use of scientific tools, equipment and resources in development and preservation.
D8- Demonstrating awareness of current problems and modern visions in the field of theoretical chemistry.
D9- Identifying professional problems and finding solutions to them.
D10- Mastering an appropriate range of professional skills in the field of theoretical chemistry, and using appropriate technological means to serve his professional practice.
D11- Communicating effectively and being able to lead work teams.
D12- Making decisions in different professional contexts.
D13- Employing available resources to achieve the highest benefit and preserving them.
D14- Demonstrating awareness of his role in developing society and preserving the environment in light of global and regional changes.
D15- Managing time efficiently.
D16- Acting in a manner that reflects commitment to integrity, credibility and commitment to the rules of the profession in the field of theoretical chemistry.
D17- Developing himself academically and professionally and capable of continuous learning in the field of theoretical chemistry.

Teaching and learning methods

1- Lecture method and use of interactive whiteboard.

2- Explanation and clarification.

3- Providing students with the basics and additional topics related to the outputs of thinking and chemical analysis.

4- Forming discussion groups during lectures to discuss chemistry topics that require thinking and analysis.

5- Asking students a set of mental questions during lectures such as what, how, when and why for specific topics.

6- Giving students homework that requires self-explanations in causal ways.

7- Discussions via the electronic class Google Classroom.
8- Audio and video lectures via the Google Meet platform
9- Lectures interspersed with PowerPoint Presentations
Evaluation methods
1- Evaluating the student's performance during the lecture.
2- Evaluating the student's performance during the field research as part of the practical evaluation.
3- Short exams during the semester.
4- Theoretical evaluation exam for the middle and end of the semester.
5- Comprehensive exam and approval of the research plan.
6- Scientific discussion of the doctoral student's thesis.

1. Program Structure

Credit hours		Course name	Course code	Academic Stage PhD
Theoretical	Theoretical			
	3	**Micro Organic Analysis, elemental and Mass Spectrometry**		First Course All Specializations
	3	**Synthesis reactions involved carbanions and (3,4,5) -membered heterocycles beside studying chemo selectivity and regioselectivity**		
	3			

		Quantum mechanics and kinetic theories of the catalytic reactions		
	3	**Bonding in transition-metal complexes and study their stability**		
	1	**English Language**		
	0	**Seminar**		
	3	**Inductivity Coupled Plasma – Atomic Emission Spectroscopy (ICP-AES) & Statistics for Analytical Chemistry**		**PhD Second Course Analytical Chemistry**
	3	**Organic reagents in analytical chemistry and their application**		
	3	**Modern Trends in Analysis of Environmental Pollutants**		
	3	**Molecular imprinted polymer technology and its application**		
	3	**scientific research methodology**		
	3	**Synthesis and reactions of condensed(five, six membered) and azoles heterocyclic**		**PhD Second course in Organic Chemistry**
	1	**Application of some reactions in natural products biosynthesis**		
	1	**Mechanism and Structure in Organic Chemistry**		
	3	**Chemo selectivity in organic chemistry**		
	3	**scientific research methodology**		
	3	**Micro Organic Analysis, elemental and Mass Spectrometry**		First Course All Specializations
	3	**Synthesis reactions involved carbanions and (3,4,5) -membered heterocycles beside studying chemo selectivity and regioselectivity**		
	3	**Quantum mechanics and kinetic theories of the catalytic reactions**		
	3	**Bonding in transition-metal complexes and study their stability**		
	1	**English Language**		
	1	**Seminar**		

	3	**Modern Electrochemistry surface**		**PhD Second course in Physical Chemistry**
	3	**Advanced Nano chemistry**		
	3	**Quantized Spectroscopy**		
	3	Optional topic		
	1	Writing methods (research, letter, thesis)		

Planning for personal development-
- Follow up on scientific developments by contacting international universities via the Internet
- Participation in scientific conferences inside and outside Iraq
- Participation in scientific workshops and seminars inside and outside Iraq
- Field visits to industrial projects

Curriculum Skills Map

Please tick the boxes corresponding to the individual learning outcomes of the programme being assessed.

Required learning outcomes of the program																	
General and transferable skills (other skills related to employability and personal development)				Emotional and value goals				Program specific skill objectives				Cognitive objectives				Essential or optional	Course name	Course code
د 4	د 3	د 2	د 1	ج 4	ج 3	ج 2	ج 1	ب 4	ب 3	ب 2	ب 1	أ 4	أ 3	أ 2	أ 1			
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	essential	**Micro Organic Analysis , elemental and Mass Spectrometry**	
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	essential	**Synthesis reactions involved carbanions and (3,4,5)-membered heterocyclic beside studying chemoselectivity and regioselectivity**	
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	essential	**Quantum mechanics and kinetic theories of the catalytic reactions**	
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	essential	**Bonding in transition-metal complexes and study their stability**	
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	essential	**English Language**	
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	essential	**Seminar**	
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	essential	**Inductivity Coupled Plasma – Atomic Emission Spectroscopy (ICP-AES) & Statistics for Analytical Chemistry**	
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	essential	**Organic reagents in analytical chemistry and their application**	
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	essential	**Modern Trends in Analysis of Environmental Pollutants**	
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	essential	**Molecular imprinted polymer technology and its application**	
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	essential	**High-performance capillary electrophoresis: principles and applications**	
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**optional**	**Optional topic**	
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	essential		

																Writing methods (research, letter, thesis)	
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	essential	**Barbara at Restens AF Heterocycle (Pentagon at Hexagon) Spy Rings at AzlasSynthesis and reactions of condensed(five, six membered) and azoles heterocyclic**	
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	essential	**Chemistry of cyclic imides and isoimides**	
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	essential	**Application of some reactions in natural products biosynthesis**	
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	essential	**Mechanism and Structure in Organic Chemistry**	
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	essential	**Chemical selectivity in organic chemistry**	
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**optional**	**Optional topic**	
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	essential	**Writing methods (research, letter, thesis)**	
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	essential	**Modern Electrochemistry surface**	
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	essential	**Advanced Nanochemistry**	
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	essential	**Spectral diagnosis according to quantum mechanics**	
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**optional**	**Optional topic**	
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	essential	**Writing methods (research, letter, thesis)**	
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	essential	**Writing methods (research, letter, thesis)**	

Accurate organic analysis, elements and mass spectrometry
Micro Organic Analysis, elemental and Mass Spectrometry

Course Description

This course description provides a concise summary of the main features of the course and the learning outcomes expected of the student, demonstrating whether the student has made the most of the learning opportunities available. It must be linked to the programme description.

1. Educational institution	Ministry of Higher Education and Scientific Research - University of Baghdad
2. Academic department/center	University of Baghdad Scientific
3. Course name/code	Analytical Chemistry / Micro Organic Analysis, Elemental Analysis and Mass Spectrometry
4. Available forms of attendance	Weekly (Personal Classroom Attendance for PhD Students and All Specializations)
5. Semester/year	First Course - (2023-2022)
6. Number of study hours (total)	45 and weekly 3 hours for PhD students
7. Date this description was prepared	1 /9/ 2022

Course objectives

Raising the level of education and the level of graduate students to the scientific and research level required to manage scientific, industrial and academic institutions and to link with all institutions and ministries by providing an important technique in the field of analytical chemistry to analyze elements and organic and inorganic compounds in general through various chemical reactions based on the active groups of organic compounds without suffering from the effects of foreign substances and is characterized by sensitivity to move towards low concentrations and a very small volume to be used in all industrial, environmental, health and scientific research fields. 1. Course Outcomes and Teaching, Learning and Evaluation Methods

A- Knowledge and Understanding or Conventional Objectives:

A1- Obtaining a PhD in Chemistry

Getting acquainted with the technique of analysis using inductively coupled plasma spectroscopy with atomic emission spectroscopy and using it in diagnosing many organic and inorganic compounds, medicines and ions

A2- Applying this technique through working in the field of health, pathological analysis and industry

A3- Applying this technique in the field of the Ministry of Industry and Oil in analyzing and processing petroleum derivatives

A4- Graduating a scientific researcher armed with all analytical techniques in addition to this technique and mechanism and relying on oneself in facing and solving all malfunctions, whether in devices or practical problems for any analytical method
A5- Working in the field of the Ministry of Agriculture and analyzing all pollutants, whether in soil or plants, and knowing their concentrations and selective reagents for their diagnosis
A6- Working in the field of the Ministry of Environment and analyzing all pollutants (air, water, soil).
B - Course specific skill objectives
B1 -- Develop skills through practical preparation and experiments
B2 - Hold seminars, conferences and study groups
B3 - Hold discussion groups
B4 - Training courses and workshops and acquire initial knowledge in analytical systems and the terminology used and qualify the student to learn about all analytical sciences and develop learning skills in using all analytical devices and all samples available in the local market
Teaching and learning methods

1. Use technological educational means to facilitate the comprehension of the material, including explanation and discussion
2. Emphasize the practical aspect and student participation in each electronic lecture
3. Urge students to use the discs prescribed for the material or listen to the lecture electronically with various means of clarification from various websites on the Internet and presentations and scientific films
Evaluation methods
Written tests - oral tests - observation - daily training - completing assignments - completing assignments Practical, theoretical and discussion during lectures and final exams
C- Emotional and value objectives
C1-- The ability to monitor and collect environmental data for the purpose of analysis using available technology
2- Making the student look at the results from a broad scientific point of view for the purpose of in-depth interpretation
Teaching and learning methods

1. Using technological educational means to facilitate the comprehension of the material, including explanation and discussion
2. Emphasizing the practical aspect and student participation in each lecture
3. Explanation and discussion. And making student participation the main focus of learning for the purpose of enhancing their understanding of the material.
4. Asking students to prepare various activities, reports and topics related to the scientific material studied.
Evaluation methods
Written tests - Daily oral tests - Daily participation - Preparing, writing and discussing assignments

D- General and transferable qualification skills (other skills related to employability and personal development).
D1- Leadership and effective communication skills to manage scientific and industrial institutions, laboratories or pathological analyzes with the least cost and time period.

D2- Mastering the skill of dealing with different mechanisms for statistical analysis and data processing.
D3- Developing skills and gaining experience through listening, speaking and personal practice.
D4- Using theoretical and practical information and investing it in the actual practical aspect.

Course structure .1

Evaluation method	Teaching method (in-person)	Unit Name / Topic First Course - (2023-2024)	Required learning outcomes	hours	week
Short and semester exams and daily assignments	Lectures using the blackboard	**Analysis of Carbonyl compounds**	Carbonyl compounds	3	1
	Lectures using the blackboard	**- Analysis of Hydroxyl compounds**	Alcohols	3	2
	Lectures using the blackboard	**Analysis of Carboxyl compounds** **Analysis of Amino compounds**	Carboxylic acids and amines	3	3
	Lectures using the blackboard	**Analysis of Alkoxyl & oxyalkylene compounds** **- Analysis of Epoxide compounds** **- Analysis of Esters compounds**	Oxo compounds	3	4
	Lectures using the blackboard	**- Analysis of Anhydride compounds** **- Analysis of Unsaturation compounds** **- Analysis of Diazonium salt compounds** **- Analysis of Hydrazine's & Hydrazides compounds**	Miscellaneous compounds	3	5
	Lectures using the blackboard	**Analysis of Mercaptans compounds** **- Analysis of Dialkyl Disulphides compounds** **- Analysis of Dialkyl Sulphides compounds** **- Analysis of Sulphoxide compounds**	Mercaptan compounds	3	6و7

		- Analysis of Sulphonic acids , Sulphonate Salts & Sulphonamides compounds			
	Lectures using the blackboard	Theoretical basis, mechanism of CHNS, CHN and CNS analyzers and molecular weight calculation for element identification	Elemental analysis and molecular weight determination	3	8
	Lectures using the blackboard	Theoretical basis, mechanism and types of ionization sources	Mass spectroscopy	3	9
	Lectures using the blackboard	Types of magnetic fields used and the laws related to them and their effect on the separation of ionic fragments	Mass spectra analysis	3	10
	Lectures using the blackboard	Mathematical laws for identifying the structural or molecular formula	Mass spectra analysis	3	11
	Lectures using the blackboard	Element analysis by mass spectrum and calculating the atomic mass unit of elements and identifying their isotopes	A Mass spectra analysis	3	12
Short and semester exams and daily assignments	Lectures using the blackboard	Writing the proposed possibilities for all organic compounds in detail to identify the organic compound	Mass spectra analysis	3	13 و14 15
	Lectures using the blackboard	Monthly exam.	Exam	3	16

	1. Curriculum development plan:
	Continue to develop the curriculum based on recent editions of books and references.
Spectrochemical analysis (Ingle & Crouch) 1988 **Modern analytical chemistry (Davide H.) – 2000** **Principles of quantitative chemical analysis (Robert de Levie) – 1997** **In addition to the international network of the Internet**	Required textbooks
Douglas A.Skoog , Donald M. West & F.James Holler , Stanley R.Crouch , Foundamentals of Analytical Chemistry , 2004 , eight edition , THOMSON , Australlia.	Main references (sources)
(Software and websites)	Recommended books and references (scientific journals, reports, etc.)

Foundamentals of Analytical chemistry From (Google chrome)	Electronic references, websites, etc.

PhD / First Course
Synthesis reactions involved carbanions and (3,4,5) -membered heterocycles beside studying chemo selectivity and regioselectivity

Course Description

This course description provides a concise summary of the main features of the course and the learning outcomes expected of the student, demonstrating whether the student has made the most of the learning opportunities available. It must be linked to the programme description.

University of Baghdad / College of Science	1. Educational Institution
Department of Chemistry	2. University Department/Center
Preparatory reactions including carbane ion and heterogeneous rings (3,4,5) in addition to the study of chemical and orientational elections	3. Course Name/Code
Attendance in the lecture according to the lists of students' names	4. Available Attendance Forms
First semester / 2023-2022	5. Semester/Year
(3) hours per week	6. Number of Study Hours (Total)
2022/9/1	7. Date this Description was Prepared
Course objectives .2	
The aim of teaching advanced topics in organic chemistry to doctoral students is to broaden students' knowledge of new topics in organic chemistry that they have not previously studied, to identify new reactions, and to work on linking the information base and stock they have in this specialization with new information on reactions, mechanisms, selectivity, activity, protection of active groups, protection factors with various oxidizing and reducing agents.	

Course structure .3

Evaluation method	Teaching method	Name of unit/course or topic	Required learning outcomes	hours	Week
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Introduction of different functional groups on compounds and how to remove them	How to introduce and remove functional groups	**3**	**1**
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Chemoselectivity and its role in reactions and preparations	Learn about chemoselectivity	**3**	**2**
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Protection of functional groups / reagents / How to remove	Learn how to protect functional groups	**3**	**3**
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Activation of substituted groups	Learn about methods of activating groups	**3**	**4**
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Study of directing reactions in specific paths	Learn about directionality of reaction pathways	**3**	**5**
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Planning and chemical preparations	Learn about planning organic preparations	**3**	**6**
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Preparation of compounds carrying functional groups in (1,2) and (1,3)	Compounds bearing two functional groups at sites (1,2) and (1,3)	**3**	**7**
Discussion, Exams and	Lecture with examples and discussion	Preparation of compounds substituted	Compounds substituted with functional groups	**3**	**8**

Seminar Preparation		with functional groups in (1,4) and (1,6)	at sites (1,4) and (1,6)		
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Different reactions of active methylene compounds	Study of alkylation, acylation and condensation of methylene compounds	**3**	**9**
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Study of thiol and thiophenol compounds / Preparation / Synthesis / Reactions	Learn about thiols and thiophenols	**3**	**10**
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Study of thioether compounds / Preparation / Synthesis / Reactions	Thioethers	**3**	**11**
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Study of different methods for preparing nitriles	Learn about nitriles	**3**	**12**
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Reactions of different nitriles with mechanics	Learn about the activity and reactions of nitriles	**3**	**13**
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Preparation and reactions of isonitriles	Learn about isonitriles	**3**	**14**
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Study of classification of quinone compounds and different preparation methods	Quinones/classification and preparation methods	**3**	**15**
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Study of different reactions with mechanics of quinone compounds	Learn about the reactions of quinones	**3**	**16**
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Study of preparation methods and reactions for heterogeneous tri and quaternary rings	Learn about the chemistry of heterocyclic tricyclic and quaternary rings	**3**	**17**
Discussion, Exams and Seminar Preparation	Lecture with examples and discussion	Study of preparation methods and reactions for pentagonal rings Heterogeneous	Learn about the chemistry of heterocyclic pentacyclic rings	**3**	**18**

	1. Infrastructure
	1. Required textbooks
	2. Main references and sources
Scientific journals (various local and international)	1(Recommended books and references)(scientific journals, reports..)
	2(Electronic reference, websites,...)

	12. Curriculum development plan
During the lectures, questions are asked about some points and the student is assigned to them as a homework to be discussed in the next lecture, which increases the student's knowledge and benefit from the scientific discussion.	The curriculum can be developed through:
Assigning students to prepare a seminar on selected topics so that the seminar includes what is mentioned in scientific magazines, books and electronic references, which contributes to the student's scientific enrichment	

PhD first course

Quantum mechanics and kinetic theories of the catalytic reactions

Course Description

This course description provides a concise summary of the main features of the course and the learning outcomes expected of the student, demonstrating whether the student has made the most of the learning opportunities available. It must be linked to the programme description.

University of Baghdad / College of Science	1. Educational institution
Department of Chemistry	2. Academic department/center
Kinetics of Catalyzed Reactions / First Course	3. Course name/code
Lists of Names	4. Available forms of attendance
First Semester 2023_2022	5. Semester/year
3 Theoretical Hours Per Week	6. Number of study hours (total)
2022/ 9/ 1	7. Date this description was prepared
أهداف المقرر **The course aims to: Identify the types of reactions, reaction rate theories, and modern techniques used in measurement, and identify the negative and positive conditions that can affect the rates of speeds and the types of auxiliary factors.**	

5. Course outcomes, teaching, learning and evaluation methods

A- Cognitive objectives

A1-A- Knowledge and understanding

A1-Types of reactions and how to improve their speed determination

A2- Understanding the types of surfaces and the factors affecting each type

A3- Using organic and organic inhibitors for auxiliary factors

A4- Understanding the Arrhenius state enjoyed by important auxiliary factors

A5- Understanding the kinetic theories related to

B- Course skill objectives

B1- Teaching the student to benefit from the Internet and external sources to extract research and reports on the subject.

B2- Solving external problems related to the topic.

B3- Discussing students within the lecture and asking questions to expand the student's understanding.

Teaching and learning methods

Explanations through curves and mathematical functions.

Approved books

Paper lectures

Basic scientific books

Modern scientific research

Evaluation methods

Short exams (oral and written) and continuous monthly exams

Reports and research required from the student

C- Emotional and value goals

C1- Communication with students

C2- Reaching scientific thinking and deductive analysis of scientific information

D- General and transferable qualification skills (other skills related to employability and personal development).

D1- Conducting scientific debates with other universities

D2- Ability to gain experience in collecting and analyzing scientific material and giving seminars

Course structure .4					
Evaluation method	**Teaching method**	**Unit name/topic**	**Required learning outcomes**	**hours**	**week**
Daily and monthly exams and seminars	**Power point**	**Potential energy Diagrams. Kinetics of hetrogenes reaction**	Kinetics of reactions	**3**	**1-2**
Daily and monthly exams and seminars	**Power point**	**Adsorption and desorption Kinetics, types and rate of adsorption**	Adsorption	**3**	**3-4**
Daily and monthly exams and seminars	**Power point**	**Kinetic of incorporation. Incorporation and pressure.**	Combination	**3**	**5-6**
Daily and monthly exams and seminars	**Power point**	**Kinetics of surface reaction.**	Surface reactions	**1.5**	**7**
Daily and monthly exams and seminars	**Power point**	**Compensation effect in catalytic reaction.**	Substitution effect	**1.5**	**8**
Daily and monthly exams and seminars	**Power point**	**Catalysist and catalysis and its application. Poto-catalytic reaction (fenton reaction)**	Catalyzed reactions	**1.5**	**9**
Daily and monthly exams and seminars	**Power point**	**The gases, kinetic molecular theory of gases, types of motion. The theories of reaction rate.**	Kinetic theory	**3**	**10-11**
Daily and monthly exams and seminars	**Power point**	**Lindman's theory Reaction in solution. Ionic strength, acid, basic catalysis**	Reactions in solution	**1.5**	**12**
Daily and monthly exams and seminars	**Power point**	**Enzyme kinetics Molecularcollision, distribution & velocities, Boltzman, Maxuall**	Enzymatic reactions	**1.5**	**13**
Daily and monthly exams and seminars	**Power point**	**Compressibility factor and non-idea behavior**	Ideal and non-ideal gas	**1.5**	**14**
Daily and monthly	**Power point**	**Rates and kinetic model of catalytic reaction.**	Rates of reactions	**1.5**	**15**

exams and seminars					

.5 **Infrastructure**	
1- Required textbooks	**Physical Chemistry text book**
2- Main references (sources)	
A) Recommended books and references (scientific journals, reports, etc.)	**Internet and electrochemistry** **Modern Electrochemistry**
B) Electronic references, Internet sites	

1. Curriculum development plan
Updating the scientific material Using modern technologies

PhD/First Course

Bonding in transition-metal complexes and study their stability

Course Description

Study of the valence bond theory, its benefits and limitations, crystal field theory, applications of crystal field stability energy - and oxide mixtures, molecular orbital theory, comparison between the three theories.

University of Baghdad	1. Educational institution
College of Science / Department of Chemistry	2. Academic department/center
Cohesion in Transitional Metal Complexes and Stability Study	3. Course name/code
Weekly	4. Available forms of attendance
First Semester / 2023-2022	5. Semester/year
45 Hours	6. Number of study hours (total)
1\9\2022	7. Date this description was prepared

8. Course objectives

1- Preparing and qualifying students for the labor market, by preparing specialized cadres in chemistry sciences capable of working in the field of specialization.
2- Comprehensive knowledge of the sciences and basic principles related to chemistry sciences.
3- Preparing, qualifying and following up on postgraduate studies by developing their intellectual, scientific and research skills.
4- Expanding and deepening students' information and skills in the field of chemistry sciences.
5- Enabling students to think and write scientific reports and research.
6- Students acquire the ability to research and learn in the fields of chemistry sciences.
7- Providing service to the community in all fields of chemistry sciences related to industrial, environmental, health, agricultural and other research.

8- Refining the student's scientific and laboratory personality so that he can serve and develop the community.
The extent of information derived from them and the determinants of these theories, the theory of the valence bond and its benefits and determinants, the theory of the crystal field, applications of the energy of the stability of the crystal field - and the mixture of oxides, the theory of the molecular orbital, a comparison between the three theories.
9- Students acquire applied and experimental skills through theoretical and laboratory scientific topics.

10- Students are familiar with the latest developments in the fields of chemistry and technology.

9. Course outcomes, teaching, learning and evaluation methods
A- Cognitive objectives.
A1- The student should be able to identify the nature of the bond between the metal and the ligand
A2- Identify the characteristics of the bond between the metal and the ligand and how to represent it orbitally

B- Program specific skill objectives:
B1- Identify the currently adopted theories to describe the nature of the bond between the metal and the ligand
B2- Identify the information derived from the application of bonding theories and benefit from them
Teaching and learning methods
1- Traditional lecture + Power Point presentation lecture
2- Preparing reports and homework

Evaluation methods
1- Research evaluation
2- Theoretical tests
3- Reports and studies.
4- Daily exams with self-solved questions.
5- Grades determined by homework.
6- Final exam.
7- Comprehensive exam.
C- Emotional and value objectives:
C1- Discussions
C2- Reports and homework

Teaching and learning methods

Using modern illustrative means such as display screens, displaying pictures, drawings and models

Evaluation methods

1- Student contribution to discussions

2- Evaluation of commitment to attendance

3- Discussion of reports

D- General and transferable qualification skills (other skills related to employability and personal development).

D1- Encouraging students to rely on some sources in preparing reports

D2- Clarifying the general foundations in classifying materials and identifying their cognitive importance

10. Course structure

Evaluation Method	**Teaching method**	Unit name / or topic	**Required learning outcomes**	**hours**	**Week**
Exams Homework Attendance	Traditional lecture + power point lecture	The emergence of coordination compounds and their types	**Development of coordination compounds and their classes**	**3**	First
Exams Homework Attendance	Traditional lecture + power point lecture	Old theories to describe the structure of coordination compounds	**Old's theories for describing the structure of coordination compounds**	**3**	Second
Exams Homework Attendance	Traditional lecture + power point lecture	Types of ligands and isomerism in coordination compounds and Sedwick's principle for the electronic description of the coordination bond	**Types of ligands and isomerism in coordination compounds. The Sedwick concept for the electronic description of the coordinate bobd**	**3**	Third
Exams Homework Attendance	Traditional lecture + power point lecture	The importance and applications of the effective atomic number rule for coordination compounds and Paulinck's rule of electronic equivalence	**The importance and applications of the effective atomic number rule for coordination compounds and electro-neutralization principle for Paulink**	**3**	Fourth

		Exam	**Exam.**	**3**	Fifth
Exams Homework Attendance	Traditional lecture + power point lecture	The foundations of hybridization and the properties of hybrid orbitals and their orbital representation	**The foundations of hybridization and the properties of hybrid orbitals and their orbital representation**	**3**	Sixth
Exams Homework Attendance	Traditional lecture + power point lecture	Modern bonding theories - hypotheses and the extent of information derived from them and the limitations of these theories	**Modern contemporary theories - hypotheses, extent and the information resulted from these theories and their limitations**	**3**	Seventh
Exams Homework Attendance	Traditional lecture + power point lecture	The theory of valence bond and its benefits and limitations	**Valence Bond Theory (VBT) and its advantages and limitations**	**3**	Eighth
Exams Homework Attendance	Traditional lecture + power point lecture	The theory of crystal field	**Crystal Field Theory (CFT)**	**3**	Ninth
Exams Homework Attendance	Traditional lecture + power point lecture	Continuity	**Cont…….**	**3**	Tenth
Exams Homework Attendance	Traditional lecture + power point lecture	Applications of the stability energy of the crystal field - and the mixture of oxides	**Applications of CFSE and Spinel Oxides**	**3**	Eleventh
Exams Homework Attendance	Traditional lecture + power point lecture	The theory of molecular orbitals	**Molecular Orbital Theory (MOT)**		Twelfth
Exams Homework Attendance	Traditional lecture + power point lecture	Comparison between the three theories	**Comparision between the Three Theories**		Thirteenth
		Exam	**Exam.**	**3**	Fourteenth

11. Infrastructure	
G.L.Miessler and D.A.Tarr , Inorganic chemistry . 2nd Ed, Prentice Hall, Upper Saddle , River, NJ, (1999).	1- Required textbooks
Satya prakash G.D. Tuli S.K. Basu R.D. Madan, Advanced Inorganic Chemistry Volume II (2008). **F.A.Cotton and G.Wilkinson Basic inorganic chemistry.3rdEd,Wiley New york, (1995) .**	2- Main references (sources)
Chemistry of transition elements **Coordination Bonds** **Inorganic chemistry**	3- Recommended books and references (scientific journals, reports, ...)
Electronic references were used.	**4-Electronic references, websites**

12. Curriculum development plan
Increasing use of information technology, extracting reliable e-books, and updating vocabulary and curricula to ensure keeping pace with the great development in the world of technology.

PhD, second course, Analytical Chemistry specialization

Inductivity Coupled Plasma – Atomic Emission Spectroscopy (ICP-AES) & Statistics for Analytical Chemistry

Course Description

This course description provides a concise summary of the main features of the course and the learning outcomes expected of the student, demonstrating whether the student has made the most of the learning opportunities available. It must be linked to the programme description.

1. Educational institution	Ministry of Higher Education and Scientific Research - University of Baghdad
2. Academic department/center	University of Baghdad Scientific
3. Course name/code	Analytical Chemistry / Inductive Coupled Plasma – Atomic Emission Spectroscopy (ICP-AES)
4. Available forms of attendance	Inductive Coupled Plasma Spectroscopy and Data Processing
5. Semester/year	Weekly (classroom attendance for PhD students)
6. Number of study hours (total)	Second Course - (2023-2022)
7. Date this description was prepared	1 /9/ 2022

Course objectives

Raising the level of education and the level of graduate students to the scientific and research level required to manage scientific, industrial and academic institutions and to link with all institutions and ministries by providing an important technology in the field of analytical chemistry to analyze elements and organic and inorganic compounds in general through direct or indirect injection of the material to be analyzed into the plasma torch, which operates at high temperatures of up to 10,000 degrees without suffering from the effects of foreign substances and is characterized by sensitivity to moving towards low concentrations and a very small volume to be used in all industrial, environmental, health and scientific research fields. 7. Course Outcomes, Teaching, Learning and Evaluation Methods

A- Knowledge and Understanding or Conventional Objectives:

A1- Obtaining a PhD in Chemistry

Getting acquainted with the technique of analysis using inductively coupled plasma spectroscopy with atomic emission spectroscopy and using it in diagnosing many organic and inorganic compounds, medicines and ions

A2- Applying this technique through working in the field of health, pathological analysis and industry

A3- Applying this technique in the field of the Ministry of Industry and Oil in analyzing and processing petroleum derivatives

A4- Graduating a scientific researcher armed with all analytical techniques in addition to this technique and mechanism and relying on oneself in facing and solving all malfunctions, whether in devices or practical problems for any analytical method

A5- Working in the field of the Ministry of Agriculture and analyzing all pollutants, whether in soil or plants, and knowing their concentrations and selective reagents for their diagnosis

A6- Working in the field of the Ministry of Environment and analyzing all pollutants (air, water, soil).

B - Course specific skill objectives

B1 -- Develop skills through practical preparation and experiments

B2 - Hold seminars, conferences and study groups

B3 - Hold discussion groups

B4 - Training courses and workshops and acquire initial knowledge in analytical systems and the terminology used and qualify the student to learn about all analytical sciences and develop learning skills in using all analytical devices and all samples available in the local market

Teaching and learning methods

1. Use technological educational means to facilitate the comprehension of the material, including explanation and discussion

2. Emphasize the practical aspect and student participation in each electronic lecture

3. Urge students to use the discs prescribed for the material or listen to the lecture electronically with various means of clarification from various websites on the Internet and presentations and scientific films

Evaluation methods

Written tests - oral tests - observation - daily training - completing assignments - completing assignments Practical, theoretical and discussion during the lecture and final exams

C- Emotional and value objectives

C1-- The ability to monitor and collect environmental data for the purpose of analysis using available technology

2- Making the student look at the results from a broad scientific point of view for the purpose of in-depth interpretation

Teaching and learning methods

Evaluation methods

Written tests- Daily oral tests- Daily participation- Preparing, writing and discussing assignments

D- General and transferable qualification skills (other skills related to employability and personal development).

D1- Leadership and effective communication skills to manage scientific and industrial institutions, laboratory or pathological analyses with the least cost and time

D2- Mastering the skill of dealing with different mechanisms for analysis and statistical processing of data
D3- Developing skills and gaining experience through listening, speaking and personal practice
D4- Using theoretical and practical information and investing it in the actual practical aspect

Course structure .6

Evaluation method	Teaching method	Unit name/topic	Required learning outcomes	hours	Week
Short exams and daily homework assignments	Delivering lectures in person	- Introduction , History , Definition , mechanism - Advantage & disadvantage of ICP-AES	Mechanism principle	3	1
	Delivering lectures in person	- Composition & mechanism for the formation of plasma tourch - Type of spectrophotometric coupled with ICP- AES - Type of ICP- AES .	Mechanism of action, principles, mechanism, types and applications	3	2
Short exams and daily homework assignments	Delivering lectures in person	- Type of detectors of ICP-AES . - Effect of organic solvent in ICP- AES . - Nebulization & type of nebulizer in ICP- AES .	Spraying, mechanism and applications	3	3
	Delivering lectures in person	- Type of methods for sampling - Internal standard in ICP- AES .	Modeling methods (principles and applications)	3	4
	Delivering lectures in person	- Type of interferences in ICP- AES . - Measurement for ICP-AES . - Application in ICP- AES .	Interferometers and application	3	5

	Delivering lectures in person	Type of introduction & solubility	Sample introduction and dissolution methods	3	6 و 7
	Delivering lectures in person	- Type of methods for sample introduction - Different techniques coupled with ICP- AES . - IR & FTIR coupled with ICP- AES (INSTRUMENTAL , THEORY, PRINCIPLE , MECHANISM , USES & APPLICATION) .	Conjugated spectroscopic techniques (IR and FTIR spectroscopy) principles, mechanism and applications	3	8
	Delivering lectures in person	- LASER coupled with ICP- AES (INSTRUMENTAL , THEORY, PRINCIPLE , MECHANISM , USES & APPLICATION) .	Laser spectroscopy (principles, mechanism and applications)	3	9
Short exams and daily homework assignments	Delivering lectures in person	- Microwave coupled with ICP- AES (INSTRUMENTAL , THEORY, PRINCIPLE , MECHANISM , USES & APPLICATION) . - X-Ray coupled with ICP- AES (INSTRUMENTAL , THEORY, PRINCIPLE , MECHANISM , USES & APPLICATION) .	Spectroscopic methods of analysis (microwave and X-Ray spectroscopy) principles, mechanism and applications	3	10
	Delivering lectures in person	- HPLC coupled with ICP- AES (INSTRUMENTAL , THEORY, PRINCIPLE , MECHANISM , USES & APPLICATION) .	Methods of separation by column	3	11
	Delivering lectures in person	Thermal Analysis coupled with ICP- AES (INSTRUMENTAL , THEORY, PRINCIPLE , MECHANISM , USES & APPLICATION) .	Principles, mechanism and applications	3	12

Short and midterm exams	Delivering lectures in person	Hydride generation coupled with ICP- AES (INSTRUMENTAL , THEORY, PRINCIPLE , MECHANISM , USES & APPLICATION) ..	Thermal analysis (Principles, mechanism and applications)	3	13
	Delivering lectures in person	- Treatment of data - Practical Statistics for the Analytical Scientist - Accuracy (mean results) - Precision or Spread of Data (Dispersion) - Distribution Descriptives Calibration graph & standard addition graph	Metal hydride generation	3	14 و 15

	1. Infrastructure
Spectrochemical analysis (Ingle & Crouch) 1988 Modern analytical chemistry (Davide H.) – 2000 Principles of quantitative chemical analysis (Robert de Levie) – 1997 In addition to the international network of the Internet	1- Required textbooks
Douglas A.Skoog , Donald M. West & F.James Holler , Stanley R.Crouch , Foundamentals of Analytical Chemistry , 2004 , eight edition , THOMSON , Australlia.	2- Main references (sources)
(Software and websites)	a) Recommended books and references (scientific journals, reports, ...)
Foundamentals of Analytical chemistry Google chrome	b) Electronic references, websites, ...
	1. Curriculum development plan:
	Continue to develop the curriculum based on recent editions of books and references.

PhD, second course, Analytical Chemistry
Organic reagents in analytical chemistry and their application
Academic Program Description

This academic program description provides a concise summary of the main features of the program and the learning outcomes expected of the student, demonstrating whether he has made the most of the opportunities available. It is accompanied by a description of each course within the program.

University of Baghdad	1. Educational Institution
Chemistry	2. Academic Department/Center
Department of Chemistry	3. Name of Academic or Professional Program
PhD Chemistry	4. Name of Final Certificate
Semester / Analytical Chemistry	5. Academic System:
Ministry of Higher Education and Scientific Research	Annual/Courses/Other
None	6. Accredited Accreditation Program
1/9/2022	7. Other External Influences

1. Academic Program Objectives

Three main objectives for the Analytical Chemistry course /K1/PhD students for the year 2023/2024

First/The cognitive tool in the accurate organic analysis of active groups in organic compounds and proposing different analytical methods sensitive to the quantitative estimation of these active groups in the form of colored complexes, including carbonyl and hydroxyl groups, amines, carboxylic acids and their derivatives.

Secondly/Elemental analysis of some important elements such as C, H, N, S using element analyzers CHN, CHNS, CNS and studying the working mechanism of the devices and applications and calculation paragraphs to find the simplified formula for any organic compound Empirical formula mathematically and suggesting Molecular F. for any organic compound.

Thirdly/Basics of mass spectrometry, ionization sources for the model by bombarding the model with electrons in the ionization source and MS applications in finding the relative atomic mass of the branched parts and predicting in suggesting mass spectra for many elements and organic compounds through 1- The mass of isotopes 2- The relative abundance of the isotope.

1. Required program outputs and teaching, learning and evaluation methods

A-A Cognitive objectives.

A1- How to predict the resulting mass spectrum for a specific element or organic compound from the mass of isotopes and the relative abundance of the isotope to find the relative atomic mass in Dalton units.

A2- Finding sensitive and accurate methods for the spectral estimation of important organic compounds that contain active groups that interact with elements or drugs by forming colored complexes that absorb at the highest wavelength proportional to the concentration and the possibility of separating and estimating mixtures of compounds, including sulfonic acid, sulfonates, and mercaptans, and estimating hydrazine, hydrazide, nitrile, and sulfonamide drugs using reducing agents. A3- Predicting the chemical formula of any unknown compound containing a percentage of the elements H, N, S, O, C through calculations of the empirical formula and molecular formula

B- Program skill objectives:

B1- The ability to solve mathematical problems related to the simplified formula of any compound and the molecular weight of the simplified formula and use element analyzers to estimate the elements C, H, N, S in the form of gases SO2, H2O, CO2, NO2

B2- The ability to solve MS mass spectrometry questions and find the relative atomic mass and through m\z for multiple isotopes of any element or compound.

B3- Separating and estimating mixtures of important organic compounds using the basics of advanced analytical chemistry in the vocabulary of accurate organic analysis and innovating new sensitive analytical methods by spectral estimation of many organic and inorganic elements and compounds, drugs, pesticides, biological and environmental models.

B4- Helping students use important electronic programs that facilitate their understanding of the material and encouraging them to read, follow up, and derive ideas in proposing formulas for other questions and solving them.

Teaching and learning methods

Teaching and learning methods are divided into several attempts:

1- Realistic lectures in classrooms

2- Creating a channel on the Telegram program with doctoral students.

3- Creating an electronic class with students to copy the approved academic program lectures, questions and their solutions, some homework, inquiries and clarifications related to the material.

4- Using additional electronic programs to meet students directly Google Meet, FCC, Zoom, etc. to facilitate the task of teaching students and their understanding of the material.

Evaluation methods

C- Emotional and value goals:

C1- Renewing students' confidence in themselves from a scientific point of view and through classroom and extracurricular discussions.

C2- The relationship between the professor and the student is always positive and correct and is built on mutual respect.

A3- The professor's affection and respect for the student gives the student an effective incentive to work hard and raise his academic level.

A4- The student's awareness and understanding of the harms of smoking and drugs on health and society.

Teaching and learning methods

Modern methods are used in education in addition to real lectures in classrooms, including the use of Google Classroom and sending some audio and video files to the electronic class.

Evaluation methods

- Short exams were conducted inside the classroom and homework assignments were given, as well as monthly exams in addition to informing students to prepare research and reports related to the academic program components for this course.
- The attendance and absence list plays an effective role in evaluating students and giving them grades for attendance to encourage students not to be absent and understand the lecture.

D- General and transferable qualification skills (other skills related to employability and personal development).

D1- Through the professor's positive relationship with the doctoral student throughout the course, the student is qualified to be a responsible and leading person in the future and to have a strong personality to manage and teach the scientific material, whether in classrooms or participating in conferences.

D2- The student's ability to participate effectively in seminars and workshops held in the scientific departments first and in their departments second.

D3- Active participation in the classroom and relying on students to solve some mathematical problems and discuss the solutions contributes to supporting the educational process as important elements capable of successful actual management in other ministries.

D4- For personal development, scientific sources and references and terms related to and specific to the course are used.

Teaching and learning methods

Modern methods are used in education in addition to real lectures in classrooms, including the use of the Google Classroom program and sending some audio and video files to the electronic class.

Evaluation Methods

- Short exams were conducted inside the classroom, homework assignments were given, and monthly exams were conducted, in addition to informing students to prepare research and reports on the academic program components for this course.
- The attendance and absence list plays an effective role in evaluating students and giving them grades for attendance to encourage students not to be absent and to understand the lecture

1. Program structure					
Credit hours		**Course name**	**Course code**	**Academic stage**	
practical	theoretical				
Three hours per week (theoretical)		Analytical chemistry	/	PhD / First Course	

1. Planning for personal development

- Acquiring self-education skills for students that enable them to update their scientific information in the field of precise scientific specialization.
- Using electronic simulations of some videos published on social media sites such as YouTube and others and benefiting from the experiences of the outside world that relied on electronic education and blended education (blended and electronic learning)

2. Admission criteria (setting regulations related to joining the college or institute)

- Based on the competitive exam for doctoral students approved by the Ministry, they were accepted to study for a doctorate and on different channels.
- Based on the expansions approved by the Ministry.

3. The most important sources of information about the program

-principles of instrumental of analysis by skoog ,Holler and Niman 5th edition - principles of instrumental of analysis by skoog ,Holler and Grouch 6th edition .

- fundamental of analytical chemistry by skoog ,west , Holler 6th edition

Course structure .7

Evaluation method	Teaching method	Unit name/topic	Required learning outcomes	hours	week
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Anaiysis of carbonyl groups	Analysis of carbonyl groups	3	First
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Anaiysis of Hydroxyl groups	Analysis of hydroxyl groups	3	Second

Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Anaiysis of carboxylate groups and Amino comp.	Analysis of carboxyl groups and amino compounds	3	Third
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Anaiysis of alkoxyl and oxy alkene	Analysis of alkoxyls and oxyalkenes	3	Fourth
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Anaiysis of Epoxides and Esters	Analysis of epoxides and esters	3	Fifth
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Anaiysis of Hydrides and unsaturated compounds of diazonium salts	Analysis of anhydrides and unsaturated compounds of diazonium salts	3	Sixth
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	analysis Hydrazine and Hydrazide and merciptan comp. and dialkyl disulphide	Analysis of hydrazine and hydrazide and analysis of mercaptan compounds and dialkyl disulfide	3	Seventh
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Analysis of dimethyl, monosulfide, sulfoxide, sulfonic acid and sulfonate salts	Analysis of dialkyl and monosulfide compounds, sulfoxides, sulfonic acid and sulfonate salts	3	Eighth
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Sulfonamide analysis and microelemental analysis by CHNS and CHN analyzer	Analysis of sulfonamide compounds and elemental microanalysis CHNS and CHN analyzer	3	Ninth
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Empirical formular and molecular formular and calculation	Empirical formular and molecular formular and calculation	3	Tenth
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Principles of mass spectroscopy and instrumentation – ionization sources	Principles of mass spectroscopy and instrumentation – ionization sources	3	Eleventh

Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Ion separators :single-focusing magnetic Deflection, Double-Foucsing	Ion separators :single-focusing magnetic Deflection, Double-Foucsing	3	Twelfth
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Cycloidial focusing ,Time of Flight ,Rules inMS , type of cleavage ,McLafferty rearrangment	Cycloidial focusing ,Time of Flight ,Rules inMS , type of cleavage ,McLafferty rearrangment	3	Thirteenth
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Mass spectra of elements , Elements with more abundant heavy Isotops	Mass spectra of elements , Elements with more abundant heavy Isotops	3	Fourteenth
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Mass spectra of Organic compounds : Alkanes , Branched Alkanes , Aromatic compounds , Alkenes ,Alkynes ,Aldehydes , Ketones , Esters ,Carboxylic acid ,Amides , Acid halide , Alcohol ,Halogenated compounds.	Mass spectra of Organic compounds : Alkanes , Branched Alkanes , Aromatic compounds , Alkenes ,Alkynes ,Aldehydes , Ketones , Esters ,Carboxylic acid ,Amides , Acid halide , Alcohol ,Halogenated compounds.	3	Fifteenth

PhD, second course, Analytical Chemistry
Molecular imprinted polymer technology and its application
Course Description

This course description provides a concise summary of the main features of the course and the learning outcomes expected of the student, demonstrating whether the student has made the most of the learning opportunities available. It must be linked to the programme description.

University of Baghdad	1. Educational institution
Chemistry	2. Academic department/center
Molecular Polymer Imprinting Technology and its Applications	3. Course name/code
In-person	4. Available forms of attendance
Second Semester/2023-2022	5. Semester/year
3 Hours	6. Number of study hours (total)
1/9/2022	7. Date this description was prepared

Course objectives

1- Students are introduced to the basics of molecular polymer chemistry and their importance in chemical analysis is studied

2- Teaching students about the materials used in molecular polymer chemistry technology

3- Teaching students to identify chemicals using molecular polymer chemistry technology

4- Introducing students to the types of molecular polymer chemistry

5- Teaching students about molecular polymer chemistry applications

6 How to analyze a mixture of materials in the model

1. Course outcomes and teaching, learning and evaluation methods

A- Cognitive objectives

A1- Quantitative and qualitative identification of the substance to be analyzed

A2- Learning the calculations necessary to know the quantity of the substance to be analyzed

A3- Teaching students to know the correct method of identification of the substance to be analyzed

B- Course skill objectives
B1- Scientific and theoretical education in understanding the basics of molecular polymer chemistry
B2- Scientific convergence between theoretical curricula and practical reality
B3- Finding appropriate statistical and analytical methods in how to identify chemicals And its analysis
B4-

C- Emotional and value goals
C1- The student's feeling that he is a scientific part of the scientific institution
C2- Building an advanced generation of the scientific pillar, the goal of which is to maintain the main role of the scientific curriculum
C3- Bringing the student to an advanced stage of scientific awareness, and this can be invested in the future

D- General and transferable qualification skills (other skills related to employability and personal development).
D1- Urging them to borrow scientific books from the college and department library to benefit from them scientifically
D2- Developing students' personal skills by developing them in the correct way
D3- Clarifying students' future goals, which generates the scientific motivation factor
D4- Making the scientific institution the largest incubator for students, which generates the belonging factor

Teaching and learning methods
- Using known learning methods by explaining the theoretical material
2- Using the electronic screen and electronic programs as a means to display important information during the explanation
3- Creating an electronic class and a channel on the Telegram website.
4- Adopting specialized books to provide the student with scientific foundations

Evaluation methods

1- Monthly written tests

2- Asking inferential questions during the lecture and preparing homework

3- Conducting a quick daily exam during the lecture time

4- Students must be involved in the scientific discussion during the lecture
Scientific and literary commitment is a priority in the evaluation process

D- General and transferable qualification skills (other skills related to employability and personal development).
D1- Urging them to use scientific books to benefit from them scientifically

D2- Clarifying the future goals of students, which generates the scientific motivation factor
D3- Making the scientific institution the largest incubator for students, which generates the sense of belonging

8. Course Structure					
طريقة التقييم	Teaching method	Unit name/topic	Required learning outcomes	hours	Week
Weekly Exams and Reports	Paper lectures and electronic screen	Introduction of molecular imprinting Principal methodologies of assembling recognition site functionality	Introduction of molecular imprinting Principal methodologies of assembling recognition site functionality	3	1
Weekly Exams and Reports	Paper lectures and electronic screen	Factors affecting the imprinting process Template	Factors affecting the imprinting process Template	3	2
Weekly Exams and Reports	Paper lectures and electronic screen	Functional monomer Cross-linking monomers	Functional monomer Cross-linking monomers	3	3
Weekly Exams and Reports	Paper lectures and electronic screen	Rational design of MIPs	Rational design of MIPs	3	4
Weekly Exams and Reports	Paper lectures and electronic screen	Imprinted bead formation	Imprinted bead formation	3	5
Weekly Exams and Reports	Paper lectures and electronic screen	Precipitation polymerization	Precipitation polymerization	3	6
Weekly Exams and Reports	Paper lectures and electronic screen	Particle size distribution analysis	Particle size distribution analysis	3	7
Weekly Exams and Reports	Paper lectures and electronic screen	Adsorption Isotherms	Adsorption Isotherms	3	8

Weekly Exams and Reports	Paper lectures and electronic screen	Isotherm models	Isotherm models	3	9
Weekly Exams and Reports	Paper lectures and electronic screen	Particle size studies to investigate the effect of solvents on MIPs	Particle size studies to investigate the effect of solvents on MIPs	3	10
Weekly Exams and Reports	Paper lectures and electronic screen	Scanning electron microscopy (SEM) studies	Scanning electron microscopy (SEM) studies	3	11
Weekly Exams and Reports	Paper lectures and electronic screen	Nuclear Magnetic Resonance (NMR) studies	Nuclear Magnetic Resonance (NMR) studies	3	12
Weekly Exams and Reports	Paper lectures and electronic screen	Fourier Transform Infra-Red (FTIR) analysis	Fourier Transform Infra-Red (FTIR) analysis	3	13
Weekly Exams and Reports	Paper lectures and electronic screen	Solid-State Nuclear Magnetic Resonance spectroscopy	Solid-State Nuclear Magnetic Resonance spectroscopy	3	14
Weekly Exams and Reports	Paper lectures and electronic screen	MIP applications Affinity separation Sensors Drug-delivery	MIP applications Affinity separation Sensors Drug-delivery	3	15

	1. Infrastructure
Molecularly Imprinted Polymers Karsten Haupt, -1 Ana V. Linares, Marc Bompart, and Bernadette Tse Sum Bu 2012 1st Edition -2 Molecular Imprinting Principles and Applications of Micro- and Nanostructure Polymers Edited By Lei Ye 2013	1- Required textbooks
Handbook of Molecular Imprinting Advanced Sensor Applications	2- Main references (sources)

	A) Recommended books and references (scientific journals, reports, etc.)
	a) Electronic references, websites, ...

1. Curriculum development plan
Introducing the foundations of new techniques and methods for linking with molecular polymer printing technology

PhD/Second Course

Specialization: Analytical Chemistry

Modern Trends in Analysis of Environmental Pollutants

Course Description

Study of environmental pollutant analysis for doctoral students / second semester Basics of analysis of types of environmental pollutants and methods used in the analysis of environmental pollutants. It includes a technical study of different types of devices and their uses in the analysis of environmental pollutants.

University of Baghdad	1. Educational institution
College of Science / Department of Chemistry	2. Academic department/center
Modern Trends in Environmental Pollutant Analysis	3. Course name/code
Weekly	4. Available forms of attendance
Second Semester / 2023-2022	5. Semester/year
45 Hours	6. Number of study hours (total)
1\9\2022	7. Date this description was prepared

8. Course objectives

This program offers a course on modern trends in the analysis of environmental pollutants for doctoral students / second semester, basics of analysis of types of environmental pollutants and methods used in the analysis of environmental pollutants. It includes a technical study of different types of devices and their uses in the analysis of environmental pollutants.

9. Course outcomes, teaching, learning and evaluation methods

A- Cognitive objectives.

A1- Identify the different methods for collecting polluted environmental samples and benefiting from them in analytical chemistry.

A2- Identify the different environmental pollutants, water, soil and air pollutants.

A3- Identify the types of environmental pollutants.

A4- Identify the methods for finding concentrations of pollutants and comparing them with international standards.

A5- Identify the mechanisms used to get rid of environmental pollutants.

B- Program specific skill objectives:
B1- Teaching the student how to use laboratory devices to collect polluted samples.
B2- Teaching the student how to conduct laboratory analyses of polluted samples.
B 3- Continuous discussion within the lecture and asking some external questions to expand the student's understanding of the material and the student's continuous participation in standing in front of the board to solve some mathematical and statistical problems.
B 4- Teaching the student to benefit from the Internet to extract research and summary reports on the prescribed practical material
Teaching and learning methods

1- Clarifying the scientific material through approved analytical books and creating paper lectures to explain the mechanisms used to analyze polluted water, soil, or air samples.

2- Using Google classroom to display lectures in the form of video recording and communicating with the student.

3- Proposed discussion within the lecture.

4- Continuously benefiting from the World Wide Web (Internet).
Evaluation methods

1- 1 Conducting short surprise exams every week so that the student is aware and continuously reading the curriculum.

2- Conducting monthly exams using Google forms and evaluating external reports and research required from the student.

3- 3- Conducting electronic tests.
C-Emotional and value objectives:
C1- The ability to infer and suggest external questions and issues that expand the student's thinking.

Teaching and learning methods
Clarifying the scientific material through approved analytical books and creating paper lectures to explain the mechanisms used to analyze polluted water, soil, or air samples.

Using Google classroom to display lectures in the form of video recordings and communicating with the student.
Suggested discussion within the lecture.
Continuous use of the World Wide Web (Internet).
Evaluation methods

1- Evaluating the student's performance during the lecture.

2- Evaluating the student's performance during the field research as part of the practical evaluation.

3- Short exams during the semester.

4- Theoretical evaluation exam for the middle and end of the semester.

5- Comprehensive exam.

6- Scientific discussion of the doctoral student's thesis.

D- General and transferable qualification skills (other skills related to employability and personal development).
D1- Developing the student's ability to deal with technology.
D2- Developing the student's ability to deal with the Internet and multimedia.
D3- Developing the student's ability to dialogue and discuss, thus enabling him to pass professional tests organized by local/regional/international bodies.
D4- Managing time and working within the specified time

10. Course structure

Evaluation method	Teaching method	Unit name/topic	Required learning outcomes	hours	Week
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Introduction	Collecting contaminated samples	**6**	**1-2**
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Methods used in collecting water samples	Collecting contaminated samples	**6**	**3-4**
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Introduction to the analyses used in the analysis of polluted water	Chemical tests of water	**6**	**5-6**
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Measuring pH, hardness, sulfates for polluted water	Chemical tests of water	**3**	**7**
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Measuring residual chlorine, dissolved oxygen, organic compounds	Chemical tests of water	**3**	**8**
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Measuring fats and lipids, phosphates, nitrogenous compounds	Chemical tests of water	**3**	**9**
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Measuring phenols, metals	Chemical tests of water	**6**	**10-11**
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Definition of air pollution	Chemical tests of polluted air	**3**	**12**
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Measuring hydrocarbons, carbon monoxide	Chemical tests of polluted air	**3**	**13**

Weekly exams and reports	1- Paper lectures 2- Electronic screen	Measuring nitrogen oxides	Collecting contaminated samples	**3**	**14**
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Introduction	Collecting contaminated samples	**3**	**15**

10.بنية المقرر

Evaluation method	Teaching method	Unit name/topic	Required learning outcomes	hours	Week
Daily and monthly exams and seminars	Power point	**nanochemistry**	**Review of nanochemistry**	**3**	First
Daily and monthly exams and seminars	Power point		**definitions**	**3**	Second
Daily and monthly exams and seminars	Power point		**properties,**	**6**	Third and Fourth
Daily and monthly exams and seminars	Power point		**identification**	**3**	Fifth
Daily and monthly exams and seminars	Power point		**preparation**	**3**	Sixth
Daily and monthly exams and seminars	Power point		**preparation**	**3**	Seventh
Daily and monthly exams and seminars	Power point		**- the chemistry of carbon nanomaterails**	**3**	Eighth
Daily and monthly exams and seminars	Power point		**- Quantum dots**	**3**	Ninth
Daily and monthly exams and seminars	Power point		**- Dendrimers**	**3**	Tenth
Daily and monthly exams and seminars	Power point		**Nanotemplats**	**3**	Eleventh
Daily and monthly exams and seminars	Power point		**Nanofluid**	**3**	Twelfth
Daily and monthly exams and seminars	Power point		**Smart materials**	**3**	Thirteenth

Daily and monthly exams and seminars	Power point		**Nano biochemistry**	**3**	Fourteenth
Daily and monthly exams and seminars	Power point		امتحان	**3**	Fifteenth

PhD / Second Course

Physical Chemistry Specialization

Group Theory and its Application in Chemistry

Course Description

This course description provides a concise summary of the main features of the course and the learning outcomes expected of the student, demonstrating whether the student has made the most of the learning opportunities available. It must be linked to the programme description..

University of Baghdad / College of Science	1. Educational institution
Department of Chemistry	2. Academic department/center
Group Theory and its Application in Chemistry	3. Course name/code
Group Theory and its Applications in Chemistry	4. Available forms of attendance
Name Lists	5. Semester/year
Second Semester / 2022-2023	6. Number of study hours (total)
1/9/2022	7. Date this description was prepared
1. Course Objectives	
The course aims to: Ideas about symmetry are of great importance in relation to both theoretical and experimental studies of molecular structure, and spectroscopy (infrared, Raman, ultraviolet) Nature shows a great deal of symmetry and this is particularly evident when we examine molecules in their equilibrium configurations.	

11. Course structure

Course outcomes, teaching, learning and assessment methods

Evaluation Method	Teaching method	Name of unit/course or topic	Required learning outcomes	Hours	Week
Daily tests and monthly exams	Power point	Introduction Symmetry elements and Operations - Identity (E). Rotation axes (C_n). - A plane of symmetry (σ). - Inversion center (i). - Rotation reflection axes (S_n)	**A- Cognitive objectives** **A1-A- Knowledge and understanding** **A1- Types of symmetries and how to determine symmetry elements** **A2- Understanding dipole moment through partial symmetry** **A3- Relation of symmetry with infrared and ultraviolet spectra** **A5- Understanding related kinetic theories** **B- Course specific skill objectives** **B1- Teaching the student to benefit from the Internet and external sources to extract research and reports on the subject.** **B2- Solving external problems related to the topic.** **B3- Discussing students within the lecture and asking questions to expand the student's understanding.**	**3**	**2**
Daily tests and monthly exams	Using the board	- Effect of performing successive operation on symmetry. - Examples of classification in to groups. - Commute operations. - Inverse operations. - The algebra of symmetry operation.	**3** **Teaching and learning methods** **Explanations through curves and mathematical functions.** **Approved books** **Paper lectures** **Basic scientific books** **Modern scientific research** **Evaluation methods** **Short exams (oral and written) and continuous monthly exams** **Reports and research required from the student** **C- Emotional and value goals** **C1- Communication with students** **C2- Reaching scientific thinking and deductive analysis of scientific information** **D- General and transferable qualification skills (other skills related to employability and personal development)** **D1- Conducting scientific debates with other universities** **D2- Ability to gain experience in collecting and analyzing scientific material and giving seminars**	**3**	**3**
Daily tests and monthly exams	Power point	- Determination of dipole moment according to group theory. - Determination of molecular point groups. - Chemical examples of selected point group.		**3**	**2**

		- A flow chart for determining the point group of a molecule.			
Daily tests and monthly exams	Using the board	- Character table. - Symmetry selection rules for IR and Raman spectra. - How to determine the active, in-plane and out of plane modes of vibrations in IR spectra. - How to determine the active polarized or depolarized modes of vibrations in Raman spectra.		**3**	**3**
Daily tests and monthly exams	Power point	- Representation of group. - The use of vectors. - The calculation of X®/ unshifted atoms for each type of R. - Contribution to character per unshifted atom in Γ_{3N}. - Some useful Purposes of matrices.		**3**	**3**
Daily tests and monthly exams	Using the board	- Application for use the character table and point group in determine the correct configuration of a molecule from its IR spectra.		**3**	**2**

	1. Infrastructure
- G. Davidson, " Introducing group theory for chemist" , 2000. **- F.A. Cotton "Chemical application of group theory " 1971.** **- A. Vincent " Molecular symmetry and group theory" 1977.**	1- Required textbooks
- M. David " Group theory and chemistry" 1973. **- J. P. Lowe and K.A. Peterson" Quantum chemistry " 2005.**	2- Main references (sources)
- A. H. Laguna, J. Maruani, and R. M. Weeny " Quantum systems in chemistry and physics " 1998. **- J.E. Wertz and J.R. Bolton " Electron spin resonance elementary and Practical Applications "**	a) Recommended books and references (scientific journals, reports, ...)
	b) Electronic references, Internet sites

1. Curriculum development plan
Updating the scientific material Using modern technologies

PhD / Second Course
Physical Chemistry Specialization
Advanced Nano chemistry

Course Description

definition and the properties of the nanomaterials, the classification of the nanomaterials, the preparation methodologies of the nanomaterials in addition to the identification and the characterization of the nanomaterials. .

University of Baghdad	1. Educational institution
College of Science / Department of Chemistry	2. Academic department/center
Advanced Nano Chemistry	3. Course name/code
	4. Available forms of attendance
Weekly	5. Semester/year
Second Semester / 2022-2023	6. Number of study hours (total)
2022/9/1	7. Date this description was prepared

8. Course objectives

Going through the elements of a new branch in chemistry namely as nano-chemistry; which is considered as the one of the main science that the nanotechnology is based on. These elements may include: the definition and the properties of the nanomaterials, the classification of the nanomaterials, the preparation methodologies of the nanomaterials in addition to the identification and the characterization of the nanomaterials. The bespoke elements also include a general look at the most important applications of the nanomaterials which nowadays profoundly has involved in every single sector of human being sciences

9. Course outcomes, teaching, learning and assessment methods
A-A Cognitive objectives. **A1- Enabling students to gain knowledge and understanding of chemistry in all its precise specializations.** **A2- Enabling students to gain knowledge and understanding of the chemical structures of compounds.** **A3- - Enabling students to gain knowledge and understanding of the mechanics of chemical reactions and methods of detection and diagnosis.** **A4- Enabling students to gain knowledge and understanding of practical experiments.** **A5- Striving to prepare scientists and researchers with scientific and laboratory skills of a research nature.** **A5- Providing educational programs that keep pace with technical development and conducting solid scientific research and studies.** **A6- Interacting with scientific and technical experiments and experiences in a way that serves society.** **A7- Establishing research projects that provide solutions to society's problems.** **B - Program specific skill objectives:** **B 1 - Providing students with the special skills to know the problems that society suffers from, their causes, how they are distributed and the impact of different factors on them, and knowing the most appropriate ways and means to solve these problems.** **B 2 - Providing students with the basic skills to conduct various scientific studies.** **B 3 - The graduate acquires the knowledge and research skills necessary for his academic and professional future.** **B 4 - Graduates of this program are prepared either for academic professions or practical professions in other ministries outside of higher education.** **Teaching and learning methods** **1- Lecture method and use of the interactive whiteboard.** **2- Explanation and clarification.** **3- Providing students with the basics and additional topics related to the outputs of thinking and chemical analysis for various chemical specializations.** **4- Forming discussion groups during lectures to discuss chemistry topics that require thinking and analysis.** **5- Asking students a set of mental questions during lectures such as what, how, when and why for specific topics.** **6- Giving students homework that requires self-explanations in causal ways.** **Evaluation methods** **1- Research evaluation** **2- Theoretical tests.** **3- Reports and studies.** **4- Daily exams with self-solved questions.**

5- Grades specified by homework.
6- Final exam.
7- Comprehensive exam.
C- Emotional and value objectives:
C1- Enabling students to understand chemistry in all specializations.
C2- Enabling students to solve problems related to the analysis, diagnosis and discrimination of chemical compounds.
C3- Enabling students to solve problems related to the intellectual framework of chemistry.
C4- Acquiring the skill of dealing ethically with participants in scientific research.
C5- Creating scientific competencies characterized by professionalism, transparency, honesty and integrity.

Teaching and learning methods
1- Lecture method and use of interactive whiteboard.
2- Explanation and clarification.
3- Providing students with the basics and additional topics related to the outputs of thinking and chemical analysis.
4- Forming discussion groups during lectures to discuss chemistry topics that require thinking and analysis.
5- Asking students a set of mental questions during lectures such as what, how, when and why for specific topics.
6- Giving students homework that requires self-explanations in causal ways.
Evaluation methods
1- Evaluating the student's performance during the lecture.
2- Evaluating the student's performance during the field research as part of the practical evaluation.
3- Short exams during the semester.
4- Theoretical evaluation exam for the middle and end of the semester.
5- Comprehensive exam.
6- Scientific discussion of the doctoral student's thesis.

D- General and transferable qualification skills (other skills related to employability and personal development).
D1- Preparing a graduate with a high mental capacity to be confident and make decisions.
D2- Mastering the basic skills of practicing scientific research theoretically and practically in theoretical chemistry.
D3- Writing and evaluating technical reports and scientific papers in a professional manner in the field of theoretical chemistry.
D4- Evaluating research-based methods, tools and equipment used in chemistry in all specializations.
D5- Applying the analytical approach and using it in the field of theoretical chemistry.
D5- Applying specialized knowledge in theoretical chemistry and integrating it with related knowledge in his professional practice.
D6- Optimizing the use of scientific tools, equipment and resources in development and preservation.

D7- Demonstrating awareness of current problems and modern visions in the field of theoretical chemistry.
D8- Identifying professional problems and finding solutions to them.
D9- Mastering an appropriate range of professional skills in the field of theoretical chemistry, and using appropriate technological means to serve his professional practice.
D10- Communicating effectively and being able to lead work teams.
D11- Making decisions in different professional contexts.
D12- Employing available resources to achieve the highest benefit and preserving them.
D13- Demonstrate awareness of his role in developing society and preserving the environment in light of global and regional changes.
D14- Manage time efficiently.
D15- Act in a manner that reflects commitment to integrity, credibility and adherence to the rules of the profession in the field of theoretical chemistry.
D16- Develop himself academically and professionally and be able to learn continuously in the field of theoretical chemistry.

10. Course structure

Evaluation Method	Teaching method	**Name of unit/course or topic**	Required learning outcomes	Hours	Week
Daily and monthly exams and seminars	Power point	**nanochemistry**	**Review of nanochemistry**	**3**	1st
Daily and monthly exams and seminars	Power point		**definitions**	**3**	2nd
Daily and monthly exams and seminars	Power point		**properties,**	**6**	3rd 4th
Daily and monthly exams and seminars	Power point		**identification**	**3**	5th
Daily and monthly exams and seminars	Power point		**preparation**	**3**	6th
Daily and monthly exams and seminars	Power point		**preparation**	**3**	7th
Daily and monthly exams and seminars	Power point		**- the chemistry of carbon nanomaterails**	**3**	8th
Daily and monthly exams and seminars	Power point		**- Quantum dots**	**3**	9th

Daily and monthly exams and seminars	Power point		**- Dendrimers**	**3**	10th
Daily and monthly exams and seminars	Power point		**Nanotemplats**	**3**	11th
Daily and monthly exams and seminars	Power point		**Nanofluid**	**3**	12th
Daily and monthly exams and seminars	Power point		**Smart materials**	**3**	13th
Daily and monthly exams and seminars	Power point		**Nano biochemistry**	**3**	14th
Daily and monthly exams and seminars	Power point		امتحان	**3**	15th

11. Infrastructure	
	1- Required textbooks
Concept of nano chemistry By ;Ludovico Cademartiri and Geoffrey A. Ozin 2-Nanomaterials and Nanochemistry By; C. Br´echignac P. Houdy M. Lahmani 3-Nanoparticles From Theory to Application by :Gunter Schmid	2- Main references (sources)
	3- Recommended books and references (scientific journals, reports, ...)
	4- Electronic references, Internet sites

12.Curriculum development plan
Updating scientific material **Using modern technologies**

PhD/Second Course
Specialization: Physical Chemistry
Quantum Mechanics Spectroscopy
Quantized spectroscopy

Course Description

Definition of the types of spectra with details. The present course aims to introducing this knowledge to the student.

University of Baghdad	1. Educational Institution
College of Science / Department of Chemistry	2. University Department/Center
Quantized Spectroscopy	3. Course Name/Code
Weekly	4. Available Attendance Forms
Second Semester / 2022-2023	5. Semester/Year
45 hours	6. Number of Study Hours (Total)

1-9-**2022**	7. Date this Description was Prepared

1. Course Objectives

Modern chemistry relies entirely on quantum mechanics in its understanding and interpretation of spectra.

Spectrum is based mainly on transition between quantized energy levels. This includes the structure determination of chemical systems (atoms, molecules, crystals...etc) and their reactions in the ground state, excited states, and products. Definition of the types of spectra with details. The present course aims to introducing this knowledge to the student.

Learning outcomes, teaching and learning methods and assessment

A- Cognitive objectives

A1- Explain the concept of quantum mechanics and quantized energy and define the duality of light

A2- Define light and radiation according to Maxwell Planck and the black body theory.

A3- Define radiation energy with a convexity of one of the spectrum parameters and the effect of matter with radiation in addition to knowing the spectrum regions and explaining each region in detail

A4- Introduce the student to the scientific foundations of spectra and what is their importance in practical reality.

A5-

A6-

B- Subject-specific skills

B1- Provide the opportunity to discuss the topic with students by solving problems and creating a spirit of competition among

students

B2- Apply the laws of spectra to organic and inorganic molecules.

Teaching and learning methods

1- . Approved books

2- Use of the board

3- Use of the display screen

Evaluation methods

1- Request solutions to some problems each semester.

2- Student participation in the discussion and regular attendance

3- Student exam monthly.

C- Thinking skills

C1- Holding discussion groups among students

C2- Rewarding outstanding students

Teaching and learning methods

Evaluation methods

D- General and transferable skills (other skills related to employability and personal development).

D1- Assigning students to follow up on published research and articles in international journals.

D2- Encouraging them to attend postgraduate dissertation discussions and seminars.

D3- Urging them to borrow scientific books from the university library to view and study the latest publications.

Course structure .1

Evaluation Method	Teaching method	**Name of unit/course or topic**	Required learning outcomes	Hours	Week
Monthly exam with discussion of some practical examples	In-person	PhD students	**Introduction in spectra** - Quantum mechanics - Quantization of energy and the dual nature of light. -Interaction of light with matter. -Energy classification. -Regions spectra. -Wide and intensity of transition for spectra.	9	1-3

Monthly exam with discussion of some practical examples	In-person	PhD students	**Microwaves spectra (Rotational spectra)** - Introduction in rotation of molecules. - Rotational of linear molecules. - Rotational of diatomic molecules. - Rotational of multiatomic molecules. - Measurement of Microwaves spectra (Rotational spectra). - Application of Microwaves spectra. - Questions.	9	4-6
Monthly exam with discussion of some practical examples	In-person	PhD students	**Infrared spectra** - Introduction in vibration. - Vibration of one particle. - Vibration of diatomic molecules. - Potential energy curve. - Harmonic Oscillators. - Unharmonic Oscillators. - Rotational vibration spectra. - Measurement of IR spectra	9	7-10

			- Application of IR spectra. - Questions. -		
Monthly exam with discussion of some practical examples	In-person	PhD students	**Raman spectra** - Classical theory. - Scattering of light. - Polarization. - Measurement of Raman spectra. - Rotational spectra. spectra. - Vibration - Application of Raman spectra. - Questions.	6	11-12
Monthly exam with discussion of some practical examples	In-person	PhD students	**Electronic spectra** - Electronic spectra for atoms - Electronic spectra for diatomic molecule. - Electronic spectra for multiatomic molecule. - Application of Electronic spectra. - Questions.	9	13-15

11. Infrastructure	
	1- Required textbooks
- Infrared and Raman Spectroscopy Peter Larkin **Electromagnetic Wave Propagation, Radiation, - And Scattering. Akira Ishimaru**	2- Main references (sources)

Design of Rotating Electrical Machines - Juha Pyrhonen, Tapani Jokinen and Valeria Hrabovcov´a **- Modern_Spectroscopy J. Michael Hollas Forth Edition**	
	3- Recommended books and references (scientific journals, reports, ...)
	4- Electronic references, Internet sites

12. Curriculum development plan
Updating the scientific material Using modern technologies

PhD / Second Course
Organic Chemistry Specialization
Chemistry of cyclic imides and isoimides

Course Description

This course description provides a concise summary of the main features of the course and the ي learning outcomes expected of the student, demonstrating whether the student has made the most of the learning opportunities available. It must be linked to the programme description.

1. Educational Institution	University of Baghdad / College of Science
2. University Department/Center	Department of Chemistry
3. Course Name/Code	Chemistry of Imides and Cyclic Isoimides / PhD
4. Available Attendance Forms	Attendance at the lecture according to the lists of students' names
5. Semester/Year	Second semester / 2023-2022
6. Number of Study Hours (Total)	(3) hours per week
7. Date this Description was Prepared	2022/9/1
Course objectives	
The aim of teaching the chemistry of imides and cyclic isoimides to doctoral students is to introduce students to compounds of great importance with various applications in the fields of	

medicine/pharmaceutical and pharmaceutical preparations/plastics industry, dyes and others, in addition to their multiple biological activities.

During the study, the student learns about the chemistry of these compounds in terms of preparation methods, reactions and applications.

60. Learning outcomes and teaching, learning and assessment methods

B. Cognitive objectives

A1. Expand students'

knowledge of imides and cyclic isoimides and identify the nature of their composition A2. Expand students' knowledge of the different preparation methods for this class of compounds A3. Expand students' knowledge of the reactions they enter into and how to diagnose them using spectroscopic and other methods

Course structure

Evaluation method	Teaching method	Name of unit/course or topic	Required learning outcomes	hours	Week
Exams and Seminar Preparation	Lecture in person with examples and discussion	Study of the chemical structures of imides and isoimides	Identify the structure of imides and isoimides	**3**	**1**
Exams and Seminar Preparation	Lecture in person with	Methods of preparing different imides with	Identify methods of preparing imides	**3**	**2**

	examples and discussion	mechanics and examples			
Exams and Seminar Preparation	Lecture in person with examples and discussion	Following the Diels-Alder reaction to prepare the complex with imide	Preparation of Diels-Alder complexes of some imides	**3**	**3**
Exams and Seminar Preparation	Lecture in person with examples and discussion	Preparation by using water-repellent agents or by melting	Thermal methods and the use of different water-repellent agents	**3**	**4**
Exams and Seminar Preparation	Lecture in person with examples and discussion	Using selective water-repellent agents in preparing isoimides	Preparation of cyclic isoamides	**3**	**5**
Exams and Seminar Preparation	Lecture in person with examples and discussion	Mechanical steps in preparing imides and isoimides	Mechanism of preparation of imides and isoimides	**3**	**6**
Exams and Seminar Preparation	Lecture in person with examples and discussion	Following the usual methods and microwave method to prepare unsubstituted imides	Preparation of unsubstituted cyclic imides	**3**	**7**
Exams and Seminar Preparation	Lecture in person with examples and discussion	The most important reactions of cyclic imides	Cyclic imide reactions	**3**	**8**
Exams and Seminar Preparation	Lecture in person with examples and discussion	Studying the conditions and mechanics of arranging isoimides to the corresponding imide	Isoimide arrangement	**3**	**9**
Exams and Seminar Preparation	Lecture in person with examples and discussion	Preparation of dicyclic imides	Dicyclic imides	**3**	**10**
Exams and Seminar Preparation	Lecture in person with examples and discussion	Preparation, mechanics and reactions of dicyclic isoimides	Dicyclic isoimides	**3**	**11**
Exams and Seminar Preparation	Lecture in person with examples and discussion	Preparation of polyimides by condensation polymerization with examples	Preparation of condensation polyimides	**3**	**12**
Exams and Seminar Preparation	Lecture in person with examples and discussion	Preparation of polyimides by chain polymerization	Preparation of addition polyimides	**3**	**13**

Exams and Seminar Preparation	Lecture in person with examples and discussion	Study of polymerization of isoimides by different methods	Preparation of polyisoimides	**3**	**14**
Exams and Seminar Preparation	Lecture in person with examples and discussion	Study of different applications of polyimides and isoimides	Applications of polyimides and polyisoimides	**3**	**15**
Exams and Seminar Preparation	Lecture in person with examples and discussion	Study of addition and condensation polymerization And copolymerization	Study of the types of polymerization used in the preparation	**3**	**16**

1. Infrastructure	
	1. Required Textbooks
	2. Main References and Resources
Scientific journals (various local and international)	1(Books and references recommended) (scientific journals, reports, etc.)
	2(Electronic reference, websites, etc.)

12. Curriculum development plan	
During the lectures, questions are asked about some points and the student is assigned to them as a homework to be discussed in the next lecture, which increases the student's knowledge and benefit from the scientific discussion	The curriculum can be developed through:
. Students are assigned to prepare a seminar on selected topics so that the seminar includes what is mentioned in scientific magazines, books	

and electronic references, which contributes to the student's scientific enrichment.	

PhD/Second Course

Specialization: Organic Chemistry

Mechanism and Structure in Organic Chemistry

Course Description

Knowing the methods of preparation and comparing them and the possible resulting compounds, as well as studying the different types of compounds and studying the proposed mechanism for each type of methods used to diagnose organic compounds.

University of Baghdad	1. Educational institution
College of Science / Department of Chemistry	2. Academic department/center
Mechanism of Reactions in Organic Chemistry	3. Course name/code

Weekly	4. Available forms of attendance
Second Semester \2023-2022	5. Semester/year
45 Hours	6. Number of study hours (total)
1\9\2022	7. Date this description was prepared

Course objectives.8

The aim of teaching the subject of Structures and Mechanics in Organic Chemistry is to know the methods of preparation and comparison between them and the possible resulting compounds from them.

As well as studying the different types of compounds and studying the proposed mechanics for each type.

Methods used to diagnose organic compounds.

9. Course outcomes and teaching, learning and evaluation methods

A- Cognitive objectives.

A1- Identify the preparation of organic compounds

A2- Preparation mechanics

A3- The importance of compounds and their applications

B- Program specific skill objectives:

B1- Teaching the student to benefit from the Internet and external sources to extract research and reports on the subject.

B2- Solutions to external problems related to the topic.

B3- Discussing students within the lecture and asking questions to expand the student's understanding.

Teaching and learning methods

Approved books

Paper lectures

Basic scientific books

Modern scientific research

Evaluation methods

Short exams (oral and written) and continuous monthly exams Reports and research required from the student

C-Emotional and value objectives:

C1-Communication with students

C2-Achieving scientific thinking and deductive analysis of scientific information

Teaching and learning methods

1-The lecture method and the use of the interactive board.

2-Explanation and clarification.

3-Providing students with the basics and additional topics related to the outputs of thinking and chemical analysis.

4-Forming discussion groups during lectures to discuss chemistry topics that require thinking and analysis.

5-Asking students to ask a set of mental questions during lectures such as what, how, when and why for specific topics.

6-Giving students homework that requires self-explanations in causal ways.

Evaluation Methods

1-Evaluation of student performance during the lecture.

2-Evaluation of student performance during field research as part of the practical evaluation.

3-Short exams during the semester.

4-Theoretical evaluation exam for the middle and end of the semester.

5-Comprehensive exam.

6-Scientific discussion of the doctoral student's thesis.

D-General and transferable qualification skills (other skills related to employability and personal development).

D1- Conducting scientific debates with other universities

D2- Ability to work in government and private pathological analysis laboratories

D3- Ability to gain experience in collecting and analyzing scientific material and delivering seminars

10. Course structure

Evaluation Method	Teaching method	Unit name/topic	Required Learning Outcomes	**hours**	**WEEK**
Exams	Theoretical	**Acids and bases**	Scientific Analysis and Conclusion	**3**	1st
Exams	Theoretical	**Acids and bases**	Scientific Analysis and Conclusion	**3**	2nd
Exams	Theoretical	**Further molecular rearrangements**	Scientific Analysis and Conclusion	**3**	3rd
Exams	Theoretical	**Free radical reactions**	Scientific Analysis and Conclusion	**3**	4th
Exams	Theoretical	**Free radical reactions**	Scientific Analysis and Conclusion	**3**	5th
Exams	Theoretical	**Beta elimination reactions**	Scientific Analysis and Conclusion	**3**	6th
Exams	Theoretical	**Beta elimination reactions**	Scientific Analysis and Conclusion	**3**	7th
Exams	Theoretical	**Addition reactions**	Scientific Analysis and Conclusion	**3**	8th
Exams	Teaching method	**Addition reactions**	Scientific Analysis and Conclusion	**3**	9th
Exams	Theoretical	**Addition reactions**	Scientific Analysis and Conclusion	**3**	10th
Evaluation Method	Theoretical	**Carbanions and enolization**	Scientific Analysis and Conclusion	**3**	11th
Exams	Theoretical	**Carbanions and enolization**	Scientific Analysis and Conclusion	**3**	12th
Exams	Theoretical	**Carbanions and enolization**	Required Learning Outcomes	**3**	13th
Exams	Theoretical	**Carbanions and enolization**	Scientific Analysis and Conclusion	**3**	14th

11. Infrastructure	
1- Required textbooks	
2- Main references (sources)	**Mechanism and structure in organic chemistry Edwin S .Gould**
3- Recommended books and references (scientific journals, reports, etc.)	**A Guide to the Mechanism of Organic Reactions Dr. Fadhel Suleiman Kamouna**
4- Electronic references, Internet sites	
12. Curriculum development plan	
Updating the scientific material Using modern technologies	

PhD/Second Course

Specialization: Organic Chemistry

Application of some reactions in natural products biosynthesis

Course Description

Teaching postgraduate students the basics and concepts of chemistry, natural products, studying the formation and mechanisms of their reactions in nature, the foundations and methods of their isolation, as well as studying the stereochemistry of natural product compounds.

University of Baghdad	1. Educational institution
College of Science / Department of Chemistry	2. Academic department/center
Application of some reactions in the biosynthesis of natural products	3. Course name/code
Weekly	4. Available forms of attendance
Second semester / 2023-2022	5. Semester/year
45 hours	6. Number of study hours (total)
1\9\2022	7. Date this description was prepared

8. Course objectives

Teaching postgraduate students the basics and concepts of chemistry, natural products, from studying the formation and mechanics of their reactions in nature, the foundations and methods of isolating them, as well as studying the stereochemistry of natural product compounds. Opening new horizons by presenting some concepts in new ways and innovative ways by making students interact with them to increase their knowledge of textbooks and assistance. With the presence of video lectures, the student lives in a traditional lecture

environment and with the same discussion methods by asking questions and answering the professor to ensure the integration of the foundations of a successful lecture.

9. Course outcomes, teaching, learning and evaluation methods

A- Cognitive objectives.

A1- Reaching a good understanding of the academic content of the subject of organic chemistry

A2- Preparing the student to comprehend and prepare for topics in later stages

A3- Teaching and training the student to solve exercises by following a special mechanism

A4- Instilling confidence in the students and encouraging them to the principle of dialogue and useful discussion.

A5- Allowing students to suggest new methods and ideas that help them understand difficult topics

A6- Helping students take short exams outside the time allocated for the lecture

-

B- Program skill objectives:

B1- The ability to find solutions and derive ideas for various issues and mechanics

B2- Encouraging students to read and follow up by conducting electronic and video meetings

B3- Helping students use important electronic programs that facilitate their understanding of the material

B4- Also helping them in terms of teaching them some electronic programs that facilitate the process of conducting electronic exams

Teaching and learning methods

Modern methods were used in education, including video and audio lectures SCREEN RECORDER and attaching audio and video files to the Google Classroom program and using electronic programs to meet students directly such as Google Meet, ZOOM, FCC, WEBAX, and others to facilitate the task of teaching students and their understanding of the material.

Evaluation Methods

Short exams were conducted and homework assignments were given, as well as monthly exams with a pre-set date, as well as writing reports on organic chemistry and the topics that were given.

C-Emotional and value-based objectives:
C1- Enabling students to understand chemistry in all specializations.
C2- Enabling students to solve problems related to the analysis, diagnosis and discrimination of chemical compounds.
C3- Enabling students to solve problems related to the intellectual framework of chemistry.
C4- Acquiring the skill of dealing ethically with participants in scientific research.
C5- Creating scientific competencies characterized by professionalism, transparency, honesty and integrity.

Teaching and learning methods

1- Lecture method and use of interactive whiteboard.
2- Explanation and clarification.
3- Providing students with the basics and additional topics related to the outputs of thinking and chemical analysis.
4- Forming discussion groups during lectures to discuss chemistry topics that require thinking and analysis.

5- Asking students a set of mental questions during lectures such as what, how, when and why for specific topics.

6- Giving students homework that requires self-explanations in causal ways.

Evaluation methods

1- Evaluating the student's performance during the lecture.

2- Evaluating the student's performance during the field research as part of the practical evaluation.

3- Short exams during the semester.

4- Theoretical evaluation exam for the middle and end of the semester.

5- Comprehensive exam.

6- Scientific discussion of the doctoral student's thesis.

D- General and transferable qualification skills (other skills related to employability and personal development).
D1-- Working on developing a distinguished personality for the student by developing cultural and social awareness, which qualifies him after graduation to serve the community. D2-- Working on creating a suitable scientific environment to prepare highly specialized cadres while developing their scientific and practical capabilities. D3- Communicating with graduate

students to learn about the lessons they have benefited from in their field of work to work on developing the vocabulary of these lessons. D4- Using the sources and terms specific to the course

10. Course structure					
Evaluation method	**Teaching method**	**Unit name/topic**	**Required learning outcomes**	**hours**	**Week**
Short exams, monthly exams and oral discussions	Electronic - Visual video lectures	Application of some reactions in the biosynthesis of natural products	**Purification, isolation of natural products**	**6**	**1-2**
Short exams, monthly exams and oral discussions	Electronic - Visual video lectures	Application of some reactions in the biosynthesis of natural products	**Terpenes: sesquiterpenes**	**6**	**3-4**
Short exams, monthly exams and oral discussions	Electronic - Visual video lectures	Application of some reactions in the biosynthesis of natural products	**The construction mechanisms in natural products**	**6**	**5-6**
Short exams, monthly exams and oral discussions	Electronic - Visual video lectures	Application of some reactions in the biosynthesis of natural products	**Peptides, Proteins and other amino acids derivatives: Synthesis of α-Amino acids -Acylamidomalonic Ester synthesis -Amination of α-Halogenated Acids -Alberston method -Curtius reaction[Curtius Rearrangement] -Darapsky Synthesis -Erlnmeyer-Plöchl Azlactone and Amino acid synthesis -Gabriel phtalimide synthesis -Hofmann Degradation method -Hydantion synthesis -Malonic ester synthesis -Reduction of α-ketonic Acids**	**6**	**7-8**

			-Strecker synthesis **-Modified peptides:**		
Short exams, monthly exams and oral discussions	Electronic - Visual video lectures	Application of some reactions in the biosynthesis of natural products	**Alkaloids Definitions** **-Protoalkaloids** **-General methods of structure elucidation of alkaloids** **-Determination of molecular formula** **-Functional Group analysis: functional nature of O-ATOM, Alcoholic hydroxyl group, phenolic hydroxyl group, carboxylic group, lacton rings** **-Degradation of alkaloids** **-Von- Braun's method[or tertiary cyclic amines]** **-Constitution of Ricinine** **-Synthesis of Piperic acid by** **Perkin reaction, Claisen-Schemidt reactin**	**6**	**9-10**
Short exams, monthly exams and oral discussions	Electronic - Visual video lectures		**Some Vitamins associated with the construction mechanisms:** ***Vitamin B1, Vitamin B2, Vitamin B5, Vitamin B6, Vitamin B12, Vitamin H***	**6**	**11-12**
		Semester Exams			**13-14**

11. Infrastructure	
Medicinal chemistry of natural products, Paul S.	1- Required textbooks
Comprehensive of natural products, Christenson J.	2- Main references (sources)
-Principles of organic chemistry, Salmon	3- Recommended books and references (scientific journals, reports, ...)

-Organic letters, UK reports	
https://ar.wikipedia.org/wiki/%D9%83%D9%8A%D9%85%D9%8A%D8%A7%D8	4- Electronic references, Internet sites

12. Curriculum development plan
Adding illustrative tools, especially when explaining the stereochemistry of organic compounds that contain asymmetric carbon atoms -Using electronic simulations of some typical videos published on sites such as YouTube and others, and benefiting from the global experiences that preceded the use of e-learning and blended learning (blended and electronic learning)

دكتوراه الكورس الثاني
اللغة الانكليزية

وصف المقرر

يوفر وصف المقرر هذا إيجازاً مقتضياً لأهم خصائص المقرر ومخرجات التعلم المتوقعة من الطالب تحقيقها مبرهناً عما إذا كان قد حقق الاستفادة القصوى من فرص التعلم المتاحة. ولابد من الربط بينها وبين وصف البرنامج.

8. المؤسسة التعليمية	كلية العلوم/ جامعة بغداد
9. القسم العلمي / المركز	قسم الكيمياء
10. اسم / رمز المقرر	اللغة الانكليزية
11. أشكال الحضور المتاحة	طلبة الدكتوراه
12. الفصل / السنة	مقررات
13. عدد الساعات الدراسية (الكلي)	1 ساعة في الاسبوع
14. تاريخ إعداد هذا الوصف	03/11/2022

03/11/2022

15. أهداف المقرر
Aim of this course is teaching higher education students the scientific writing in proper way in order to help students how to write thesis and articles in journals . In addition to that teaching students how can understanding passage reading properly ,.
And answer all qusions relating to these passeges. Moreover , helping students in speaking and listening by giving them speaking tips and listening to conversions between two persons or between groups.in native peoples. As well as , teaching students grammer and punctuation

16. مخرجات المقرر وطرائق التعليم والتعلم والتقييم
أ- الاهداف المعرفية أ1-**Knowledge and Understanding** أ2- **READING SKILLS** أ3- **WRITING SKILLS** أ4- **VOCABULARY DEVELOPMENT** أ5- **Language for writing**
ب - الاهداف المهاراتية الخاصة بالمقرر ب1 – **Effective reading** ب2 – **Writing assay in different fields** ب3 – **vocabulary Using different forms of**
طرائق التعليم والتعلم
Using smart board and data show for displying the leacture and improve students intereaction evironment. As well as, using short tests and monthly exams
طرائق التقييم
Short exams and doing home works and monitoring students level during this course and monthly exams
ج- الاهداف الوجدانية والقيمية ج1- Thinking Skills ج2- working in groups ج3-Make student more confident
د - المهارات العامة والتأهيلية المنقولة (المهارات الأخرى المتعلقة بقابلية التوظيف والتطور الشخصي). د1- د1- **To built a strong personality for students** د2-**To develop the students English ability that help them in future work**

17. بنية المقرر					
الأسبوع	الساعات	مخرجات التعلم المطلوبة	اسم الوحدة / أو الموضوع	طريقة التعليم	طريقة التقييم
الأسبوع 1	1	Effective reading	Education and learning	عرض وتفصيل باستخدام الشاشة	Short exam and homwork
الأسبوع 2	1	Effective reading	Education and learning	عرض وتفصيل باستخدام الشاشة	Short exam and homwork
الأسبوع 3	1	Rephrasing	Innovations in health and medicine	عرض وتفصيل باستخدام الشاشة	Short exam and homwork
الأسبوع 4	1	Rephrasing	Innovations in health and medicine	عرض وتفصيل باستخدام الشاشة	Short exam and homwork
الأسبوع 5	1	Text cohesion	Urban planing	عرض وتفصيل باستخدام الشاشة	Short exam and homwork
الأسبوع 6	1	Text cohesion	Urban planing	عرض وتفصيل باستخدام الشاشة	Short exam and homwork
الأسبوع 7	1	Monthly Exam			
الأسبوع 8	1	Identifying language	Water, food and energy	عرض وتفصيل باستخدام الشاشة	Short exam and homwork
الأسبوع 9	1	Identifying language	Water, food and energy	عرض وتفصيل باستخدام الشاشة	Short exam and homwork
الأسبوع 10	1	Distinguashing between Fact, speculation and reported opinions	Globalazation	عرض وتفصيل باستخدام الشاشة	Short exam and homwork
الأسبوع 11	1	Distinguashing between Fact, speculation and reported opinions	Globalazation	عرض وتفصيل باستخدام الشاشة	Short exam and homwork
الأسبوع 12	1	Monthly Exam			

18. البنية التحتية	
1- الكتب المقررة المطلوبة	Headway 3 book
2- المراجع الرئيسية (المصادر)	Headway 3 book
1) الكتب والمراجع التي يوصى بها (المجلات العلمية ،التقارير ،.....)	IELTS BOOK(Oxford) international english language testing system
2) المراجع الالكترونية ،مواقع الانترنيت	

19. خطة تطوير المقرر الدراسي
أستخدام الطرق التفاعلية المتطورة في التكلم والكتابة باللغة الانكليزية

Course Description / Scientific Research Methodology **(Research Methodology)**

This course description provides an identification of the most important vocabulary required for scientific research.

University of Baghdad / College of Science	1. Educational institution
Department of Chemistry	2. Department/university center
Scientific Research Methodology	3. Course name/code
Weekly	4. Available forms of assistance
Second Semester 2023-2022	5. Semester/year
1 hour = 15 x 30 hours	6. Number of hours of study (total)
1\9\2022	7. The date this description was prepared.

.. Course objectives8

It aims to teach the scientific research methodology subject, including reviewing scientific references and how to write a thesis and dissertation and publish scientific research in global containers.

9. Learning outcomes, teaching and learning methods and evaluation

A- Cognitive objectives

A1- Providing students with knowledge of the foundations of the scientific research methodology subject.

A2- Acquiring knowledge of the correct application of the rules of publishing in global containers.

B- Skill objectives

B1- Teaching the student how to extract sources.

B2- Continuous discussion within the lecture and asking some external questions to expand the student's understanding of the material and the student's continuous participation within the lecture.

Teaching and learning methods

1- Clarifying the scientific material through multiple examples and creating paper lectures and using power point technology to clarify solutions and applications.
2- Continuously benefiting from the World Wide Web unit (Internet) by displaying videos related to the topic.

Evaluation methods

1- Conducting short surprise exams for each student to be aware and continuous reading of lectures related to the scientific material.
2- Conducting continuous monthly exams and evaluating the reports and research required from the student.

C- Emotional and value objectives

C1- Giving students a number of external questions as homework and giving them the opportunity to think and find solutions.
C2- Motivating students to conduct reports and research on the subjects they study and use modern technologies in research and develop their research skills such as the Internet.

Teaching and learning methods

It is noted that our dear students are aware and conscious that they are graduate students and are committed to reading, attending lectures, conducting monthly and short exams, and abiding by university laws and regulations.

Evaluation methods

- Holding some courses and seminars in the department has a major role in educating our dear students and constructive discussion between the student and the professor.
- Academically distinguished students and participants in seminars held in the College of Science are evaluated and rewarded.

D- General and transferable skills (other skills related to employability and personal development).

D1- Conducting some scientific debates with other universities or well-known scientific centers and honoring the outstanding students among them. D2- Developing personal skills by giving poetry debates through their participation in central celebrations held within the university.

11. Course structu

Evaluation Method	Teaching method	**Name of unit/course or topic**	Required learning outcomes	Hours	We
Weekly Exams	Electronic screen	Research and researcher	The student will be able to know the basics of the scientific research methodology	1 hour	1
Weekly Exams	Electronic screen	Hidden knowledges.facts	The student will be able to know the basics of the scientific research methodology and how to choose and prepare the research topic	1 hour	2r
Weekly Exams	Electronic screen	Structure of a scientific paper	The student will be able to know the structure of the scientific article	1 hour	3

Weekly Exams	Electronic screen	Title (features of effective title, types of title)	The student will be able to know how to choose the appropriate title, abstract, introduction and conclusions when writing the research article	1 hour	4
Weekly Exams	Electronic screen	Publication process	The student will be able to know the steps to publish the research article	1 hour	5
Weekly Exams	Electronic screen	Important terminologies: Research originality	The student will be able to know some terms related to the basics of writing such as original research and valuable research	1 hour	6
Weekly Exams	Electronic screen	Related work, literature review	How to choose the required sources when writing the first chapter and reviewing references	1 hour	7
Monthly exam				1 hour	8
Weekly Exams	Electronic screen	Reviewer's suggestion and editor decision	The student will be able to know how to evaluate research scientifically and whether it is suitable for publication or not and how to make a decision to accept or reject the research for publication	1 hour	9
Weekly Exams	Electronic screen	Reviewing systems	The student will be able to know the electronic research evaluation system and the mechanism for selecting scientific evaluators and how to choose the appropriate journal for publication	Hours	10
Weekly Exams	Electronic screen	Web of science, Thomson Reuters, and Scopus	The student will be able to identify some terms such as Scopus, Clarivate and Thomson Reuters	1 hour	11
Weekly Exams	Electronic screen	Impact Factor and h-index	Explain the meaning of the impact factor and Hirsch factor	1 hour	12
Weekly Exams	Electronic screen	Plagiarism	Scientific plagiarism and electronic plagiarism		13
Weekly Exams	Electronic screen	Organization Ref. using ENDnote software	The student will be able to index and write sources using the ENDnote program		14
Monthly exam					15

.12 Infrastructure	
Required readings: Basic texts Course books Other	-Sources Web of Science, www.ScienceDirect.Com, www.Scopus.com
Special requirements (including, for example, workshops, periodicals, software, and websites)	There are websites that show explanatory videos on how to organize sources using