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 :

اسم المعاون العلمي : أ.د. خالد جابر كاظم

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. سعد كريم عبد الله

Description of the academic program

The graduate program awards a master's degree in one of the chemical specializations after completing two courses of 15 weeks and 2 to 3 hours for each course (compulsory and elective) in both courses and submitting and discussing the master's thesis by a specialized scientific committee, noting that the number of course units is 26 units and the number of thesis units is 10 units. The course description for the five chemistry majors includes the following:

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

University of Baghdad	1. Educational institution
College of Science/Chemistry	2. Scientific department/center
Academic Program of the Department of Chemistry	3. Name of the academic or professional program
Master of Science in Chemistry (Specialization)	4. Name of the final certificate
Semester	5. Academic system:
None	Annual/courses/others
Internet	6. Accredited accreditation program
2022/9/1	7. Other external influences

1. Academic Program Objectives

1- Preparing highly skilled and competent 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 increase the college's ability in sustainable development and community service.

-5 That the Chemistry Department 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 specializations, 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
1- 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 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, department and society by holding seminars, conferences and study groups 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 local, Arab, international or global seminars, study groups and conferences.

1. Required program 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 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

Research evaluation-1
2- Theoretical tests.
3- Reports and studies.
4- Daily exams with self-solved questions.
5- Specific grades with homework
6- Final 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 dealing ethically with participants in scientific research.
C3- 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 conducting 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- Scientific discussion of the graduate student's thesis or dissertation.

D- General and transferable skills (other skills related to employability and personal development).
D1- Preparing a graduate with a high mental ability 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- Decision making in different professional contexts.
D12- Employing available resources to achieve the highest benefit and preserving them.
D13- Demonstrating awareness of his role in developing society and preserving the environment in light of global and regional changes.
D14- Managing time efficiently.
D15- Acting in a manner that reflects commitment to integrity, credibility and adherence to the rules of the profession in the field of theoretical chemistry.
D16- Developing himself academically and professionally and being able to learn continuously 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 thinking 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- Scientific discussion of the graduate student's thesis.

Program structure .1

Credit hours		Course name	Course code	Academic stage
practical	theoretical			
عملي -	2	**Biological membrane and metabolism**		Master's / First course / All specializations
	2	**Thermal Analysis & Advanced separation techniques**		
	2	**Intermediates in organic chemistry mechanisms and stability**		
	2	**Chemistry of Transition elements, representative elements and their compounds**		
	2	**Quantum chemistry and advance thermodynamics**		
	1	**English Language**		
	مستوفي	**Seminar**		
	3	**Natural products chemistry**		**Master's / Second Course / Organic Chemistry Specialization**
	3	**Chemistry of the Sulfur**		
	3	**Spectrometric Identification of Organic Chemistry**		
	3	**The Nitro group in organic synthesis**		
		Stereochemistry		
	2	**Optional topic**		
	1	**English Language**		
	1	**Writing methods (research, letter, thesis)**		
	3	**\ Amplification reactions**		**Master's / Second Course / Analytical Chemistry**

	3	**Advance flow injection analysis**		
	3	**Principles and statistical of ion selective electrode**		
	3	**Advanced Analytical methods for Analysis of Elements**		
	2	**Optional topic**		
	1	**English Language**		
	1	**Writing methods (research, letter, thesis)**		
	3	**Advance corrosion chemistry**		**Master's / Second Course / Physical Chemistry Specialization**
	3	**Nano identification techniques**		
	3	**photochemistry Advanced**		
	3	**Surface phenomena and heterogeneous catalysis**		
	1	**Optional topic**		
	1	**English Language**		
	3	**Chemistry Boron**		**Master's / Second Course / Inorganic Chemistry Specialization**
	3	**Crown ethers and their complexes with transition metal ions**		
	3	**Metal Ions in Biological System**		
	3	**Electronic spectra of inorganic compounds**		
	2	**Optional topic**		
	1	**English Language**		
	1	**Writing methods (research, letter, thesis)**		
	3	**selective topics in Biochemistry**		**Master's / Second Course / Biochemistry Specialization**

	3	**Biochemistry of Blood**		
	3	**Chemistry of proteins and separation methods**		
	3	**Enzymes and their application in the clinical chemistry**		
	2	**Optional topic**		
	1	**English Language**		
	1	**Writing methods (research, letter, thesis)**		

1. Planning for personal development
- Following up on scientific development by contacting international universities via the Internet 1. Planning for personal development - Following up on scientific development by contacting international universities via the Internet - Participating in scientific conferences inside and outside Iraq - Participating in scientific workshops and seminars inside and outside Iraq - Field visits to industrial projects
1. Admission Criteria (Setting Regulations for Admission to the College or Institute)
All applicants for the Master's program in various chemistry specializations must meet the admission requirements for graduate programs as stipulated in the university's admission policy in addition to the following requirements that must be considered for admission to the university: 1- Hold a bachelor's degree from a university or college accredited by the Ministry of Higher Education or its equivalent. 2- Obtain a passing score on the TOEFL test. 3- Pass the personal interview. 4- Complete the application online on the home page of the College of Science - University of Baghdad during the admission period. 5- Pass the competitive exam, scientific test and personal interview. 6- Comparison in admission according to competition points. 7- Application mechanism according to application channels (general and special admission). 8- Competition for specialization (organic chemistry, inorganic chemistry, physical chemistry, biochemistry, analytical chemistry).
1. The most important sources of information about the program
Instructions of the Ministry of Higher Education and Scientific Research / Research and Development Department-1. 2- Instructions of the University Council and the College Council.

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**				Basic Or optional	**Course name**	**Course code**	Year / Level
د4	د3	د2	د1	ج4	ج3	ج2	ج1	ب4	ب3	ب2	ب1	أ4	أ3	أ2	أ1				
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Basic	Biological membrane and metabolism		Master's / First Course All Specializations
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Basic	Thermal Analysis & Advanced separation techniques		
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Basic	Intermediates in organic chemistry mechanisms and stability		Master's / First Course
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Basic	Chemistry of transition elements, representative elements and their compounds		

X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Quantum chemistry and advance thermodynamics		**Master's/ First Course**
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	English Language		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Seminar		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Natural products chemistry		**Master's/ Second Course/ Organic Chemistry**
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Chemistry of the Sulfur		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Spectrometric Identification of Organic Chemistry		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	The Nitro group in organic synthesis		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	= Stereochemistry		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Optional topic		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	لغة انكليزية English Language		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Writing methods (research, letter, thesis)		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Amplification reactions		**Master's / Second Course /**

																			Analytical Chemistry
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Advance flow injection analysis		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Principles and statistical of ion selective electrode		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Advanced Analytical methods for Analysis of Elements		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Modern Extraction and separation Techniques		
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**	Basic	English Language		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Writing methods (research, letter, thesis)		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	selective topics in Biochemistry		**Master's / Second Course / Biochemistry**
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Biochemistry of Blood		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Chemistry of proteins and separation proteins		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic			

																	Enzymes and their application in the clinical chemistry		
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Basic	Optional topic		
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Basic	English Language		
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Basic	Writing methods (research, letter, thesis)		
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Basic	Chemistry Boron		**Master's / Second Course / Inorganic Chemistry**
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Basic	Crown ethers and their complexes with transition metal ions		
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Basic	Metal Ions in Biological System		
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Basic	Electronic spectra of inorganic compounds		
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Basic	Optional topic		
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Basic	English Language		
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Basic	Writing methods (research, letter, thesis)		
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Basic	Advance corrosion chemistry		**Master's / Second Course / Physical Chemistry**

X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Nano identification techniques		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	photochemistry Advanced		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Surface phenomena and heterogeneous catalysis		
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**	Basic	English Language		
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Basic	Writing methods (research, letter, thesis)		

Master's/First Course

Chemistry of Transition elements, representative elements and their compounds

Course Description

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

1. Educational institution	University of Baghdad - College of Science
2. Academic department/center	Department of Chemistry
3. Course name/code	Chemistry of Transition and Representative Elements and Their Compounds / In-person
4. Available forms of attendance	Traditional Lecture + Power Point Lecture
5. Semester/year	First Semester / 2023-2022
6. Number of study hours (total)	2 theoretical hours per week
7. Date this description was prepared	1/ 9/ 2022
1. Course Objectives	
The course aims to study the following main topics: Periodic table, radii, magnetism, theories (MOT, CFT, VBT, Lewis theory, VSEPER, Werner,), quantum numbers and term symbol, coordination compounds, crystal shapes, effective atomic number rule, organometallic compounds.	

1. Course Outcomes, Teaching, Learning and Evaluation M
A- Cognitive Ob A1 The student should be able to identify the basics of inorganic ch A2 - Identify advanced inorganic ch
B - Course specific skill objecti B1 - Identify the properties of transitional and representative eleme B2 - Identify the theor B4-
Teaching and learning
1- Using traditional lectures + Pow 2- Using the displa 3- Using vis 4- Using drawings on th

Course structure

The week	Watches	Required learning outcomes	Unit name/topic	Teaching method	Evaluation method
1	2	The principle by which the periodic table was built up . Classification of the elements, The representative elements, Main transition elements ,Inner transition elements. The electronic configuration of Main and Inner transition elements	periodic table	Using the display with the writing on the board	Written exams and homework
2	2	The properties of the transition elements .The oxidation states ,Covalent and ionic radii, the factors effecting on radii ,the Lanthanide contraction	periodic table	Using the display with the writing on the board	Written exams and homework
3	2	The VSEPR, hybridization in an inorganic compounds and ions.	VSEPR	Using the display with the writing on the board	Written exams and homework
4	2	Russell-Sounders Term Symbols for G.S. and Ex. S.	Term Symbols	Using the display with the writing on the board	Written exams and homework

Written exams and homework	Using the display with the writing on the board	Coordination compounds	Coordination compounds ,historical development, properties, coordination number , nomenclature , isomerisation	2	**5**
			First exam	2	**6**
Written exams and homework	Using the display with the writing on the board	Stability constants	Stability constants of coordination compounds .Factors affecting stability of complexes	2	**7**
Written exams and homework	Using the display with the writing on the board	The carbonyls	The carbonyls and The Effective Atomic Number . The Back-Bonding.	2	**8**
Written exams and homework	Using the display with the writing on the board	Lewis Theory	Lewis Theory . The Formal Charge and the resonance form	2	**9**
Written exams and homework	Using the display with the writing on the board	The Valence Bond Theory .	The Valence Bond Theory .	2	**10**
Written exams and homework	Using the display with the writing on the board	The Crystal Field Theory	The Crystal Field Theory , factors effecting the 10Dq , the high- and low-spin complexes , the Crystal Field Stabilization energy ,the effect of crystal field on Oh,Td and Sq.p. complexes , Jahn- Teller distortion.	2	**11**

			Second exam	2	**12**
Written exams and homework	Using the display with the writing on the board	MOT	The M.O,T. , -The orbital symmetry . -The Oh molecular orbitals . -	2	**13**
Written exams and homework	Using the display with the writing on the board	MOT	The Sq. P. molecular orbitals . -The Td . molecular orbitals	2	**14**
Written exams and homework	Using the display with the writing on the board	The organometallic compounds	The organometallic compounds	2	**15**

Infrastructure .2	
	1- Required textbooks
1-Whitten,Davis,Peck, Stanely, General chemistry, 7th Ed. , Brooks/ Cole, Thomson, (2003) **2**- Martin van Duin,'BORATE ESTERS: IDENTIFICATION, STRUCTURE, STABILITY, AND CATION COORDINATING ABILITY' Delft University Press, 1986. **3**-G.L.Miessler and D.A.Tarr , Inorganic chemistry . 2nd Ed, Prentice Hall, Upper Saddle , River, NJ, (1999**)** 4-F.A.Cotton and G.Wilkinson Basic inorganic chemistry.3rdEd,Wiley New york, (1995) 5- N.N.Greenwood and A.Earnshaw , Chemistry of elements, (1999)	2- Main references (sources)
General Inorganic Chemistry	A) Recommended books and references (scientific journals, reports, etc.) B) Electronic references, websites, etc.
Electronic references were used.	A) Recommended books and references (scientific journals, reports, etc.) B) Electronic references, websites, etc.

1. 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.

Master's/First Course

Thermal Analysis & Advanced separation techniques

Course Description

Study the basics of thermal analysis chemistry and advanced separation techniques. Study their importance chemical analys

University of Baghdad	1. Educational institution
College of Science/Chemistry	2. Academic department/center
Thermal Analysis and Advanced Separation Techniques	3. Course name/code
Integrated Online and In-person	4. Available forms of attendance
First Semester 2023-2022	5. Semester/year
30 Hours	6. Number of study hours (total)
1/9/2220	7. Date this description was prepared

8. Course objectives

1- Students are introduced to the basics of thermal analysis chemistry and advanced separation techniques and their importance in chemical analysis is studied.

2- Students are taught thermal analysis methods and advanced separation techniques.

3- Students are taught to identify chemicals using thermal analysis methods and advanced separation techniques.

4- Students are introduced to the types of thermal analysis and separation techniques.

5- Students are taught the applications of thermal analysis and advanced separation techniques.

6 How to analyze a mixture of materials in the model

9. Course Outcomes, Teaching, Learning and Evaluation Metho

A- Cognitive Objectiv
A1- Determine the quantity and quality of the material to be analyze
A2- Learn the calculations necessary to know the quantity of the material to be analyze
A3- Teach students to know the correct method for determining the material to be analyze

B - Program specific skill objectives
B1 - Scientific and theoretical education in understanding the foundations and methods of thermal analysis and advanced separation techniques
B2 - Scientific convergence between theoretical curricula and practical reality
B3 - Finding appropriate statistical and analytical methods in how to identify and analyze chemical materials

Teaching and learning methods
1. Paper lectures and power point lectures
2. Electronic lectures using electronic programs (Google Meet, Google Classroom, Telegram).
3. Examples, questions and weekly discussions during the lecture.
4. Basic and modern scientific books.
5. Conducting seminars for students.

Evaluation Metho

1. Conducting exams through homework to encourage students to read lectures dail

2. Conducting short exams during the lecture to encourage students to read lectures dail

3. Conducting continuous monthly exam

4. Reports and research required from the studer

C- Emotional and value-based objectives

C1- Acquiring solid scientific methods to build the structure and structure of a successful scientific researcher to conduct analyses from a broad scientific point of view

C2- The ability to monitor and collect environmental data for analysis using various analytical devices coupled with inductively coupled plasma spectroscopy and process data using advanced statistical methods

C3- Making the student look at the analysis of environmental samples and process the results from a broad scientific point of view

Teaching and learning methods

11- Participation in conferences to highlight students' intellectual skills such as conferences - seminars - course

2- Conducting various tests among students to develop and highlight their intellectual and research energie

3- Discussing students through research projects of biological, industrial and research importanc

4- Teaching all students to publish in journals with a long history of uninterrupted publication and a broad base o subscribers within the general or precise specializatio 5- Teaching on solid software with a high database to teach all students how to check plagiarism, for examp 6- Learning how to identify the manifestations of fictitious and non-serious journa 7- Workshops, periodicals, software and websites)
Evaluation metho
1- Teaching all students to publish in journals with a long history of uninterrupted publication and a broad base of subscribers with the general or precise specializatio 2- Teaching on solid software with a high database to teach all students how to check plagiarism, for examp 3- Learning how to identify the manifestations of fictitious and non-serious journa
D- General and transferable qualification skills (other skills related to employability and persona development) D1- Research leadership and publishing in reputable journals D2- The art of composing and preparing lectures, delivery method and correspondence D3- Opportunities for developing scientific research in the Arab world D4- Flexible scientific development in dealing with all analytical and industrial devices, their mechanism o operation, calibration, repair of their faults and components, flexible dealing with these mechanisms and how to use them in wide-ranging analysis And developing the student's mental abilities - developing skill capabilities and dealing with field and laboratory environmental measurement devices

10. Course structu					
Evaluation method	Teaching method	Unit name/topic	Required learning outcomes	hours	week

Weekly Exams and Reports	1- Paper lectures 2- Electronic screen	Thermogravimetric Analysis and DTG, Fundamentals, Instrumentation	Thermogravimetric analysis & DTG , principle , Instrumentation	2	F
Weekly Exams and Reports	1- Paper lectures 2- Electronic screen	Differential Thermal Analysis, Fundamentals, Instrumentation	General Differential thermal analysis, principle , Instrumentation	2	Secc
Weekly Exams and Reports	1- Paper lectures 2- Electronic screen	Differential Thermal Analysis, Fundamentals, Instrumentation	General Differential thermal analysis, principle , Instrumentation	2	Th
Weekly Exams and Reports	1- Paper lectures 2- Electronic screen	Differential Calorimetry, Fundamentals, Instrumentation	Differential scanning calorimetry , principle , Instrumentation	2	Fou
Weekly Exams and Reports	1- Paper lectures 2- Electronic screen	DSC (or DTA) and TGA Methodology	Methodology of DSC (or DTA) and TGA	2	Fi
Weekly Exams and Reports	1- Paper lectures 2- Electronic screen	DSC (or DTA) and TGA Methodology	Methodology of DSC (or DTA) and TGA	2	Si
Weekly Exams and Reports	1- Paper lectures 2- Electronic screen	Different Aspects of Thermal Analysis	Examples : different aspects of thermal analysis	2	Seve
Weekly Exams and Reports	1- Paper lectures 2- Electronic screen	Thermo-Mechanical Analysis, Fundamentals, Instrumentation	Thermomechanical analysis , principle , Instrumentation	2	Eig
Weekly Exams and Reports	1- Paper lectures 2- Electronic screen	-Electrothermal Analysis	Electrical thermal analysis	2	Ni
Weekly Exams and Reports	1- Paper lectures 2- Electronic screen	Thermometry, Instrumentation, Methodology and Application	Thermometric titrimetry , Instrumentation , Methodology & application	2	Te
Weekly Exams and Reports	1- Paper lectures 2- Electronic screen	High Performance Liquid Chromatography, Principle, Developments, Instrumentation, Application	High Performance Liquid Chromatography , principle , Advances ,Instrumentation , & application	2	Eleve
Weekly Exams and Reports	1- Paper lectures 2- Electronic screen	High performance liquid chromatography, principle, advances, instrumentation, and application	High Performance Liquid Chromatography , principle , Advances ,Instrumentation , & application	2	Twel

Weekly Exams and Reports	1- Paper lectures 2- Electronic screen	High performance liquid chromatography, principle, advances, instrumentation, and application	High Performance Liquid Chromatography , principle , Advances ,Instrumentation , & application	2	Thirtee
Weekly Exams and Reports	1- Paper lectures 2- Electronic screen	Capillary electrophoresis, fundamentals, advances, instrumentation, and application	Capillary electrophoresis , principle , Advances ,Instrumentation , & application	2	Fourtee
Weekly Exams and Reports	1- Paper lectures 2- Electronic screen	Capillary electrophoresis, fundamentals, advances, instrumentation, and application	Capillary electrophoresis , principle , Advances ,Instrumentation , & application	2	Fiftee

11. Infrastructure	
- Fundamentals of analytical chemistry /Skoog and West ,7th ed.,2000 - Fundamental of analytical chemistry by Skoog, West, Holler & Crouch, 8th , 2004. - Fundamental of analytical chemistry by Skoog, West, Holler & Crouch, 8th , 2007.	Required textbooks
QUANTITATIVE CHEMICAL ANALYSIS Daniel C. Harris Michelson Laboratory China Lake, California Eighth Edition W.	Main references (sources)
	Recommended books and references (scientific journals, reports, etc.)
	Electronic references, websites, etc.

12. Curriculum development plan

Keeping pace with the developments in the preparation and methods of determining materials in general using thermal analyses and advanced separation techniques.

Master's/First Course

Biological membrane and metabolism

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
Biomembranes and Metabolism	3. Course name/code
List of Names	4. Available forms of attendance
First Semester / 2023-2022	5. Semester/year
2 hours per week	6. Number of study hours (total)
1\9\2022	7. Date this description was prepared
1. Course Objectives	
The objective of teaching Advanced Biochemistry is to identify metabolic pathways from the perspective of energy calculations.	
Linking the metabolic pathways of biomolecules	
Studying the harmony and integration in the function of the vital organs of the human body in different nutritional states: in the case of fasting and famine or in the case before and after meals.	

Study what happens to energy levels in each nutritional condition
Diseases resulting from a malfunction in the functioning of vital organs

Course outcomes, teaching, learning and assessment methods .3
A- Cognitive objectives A1- Identify the importance of studying energy levels resulting from the oxidation of biomolecules. A2- The importance of integration between vital organs in the body to maintain balanced energy levels. A3- Identify the types of imbalance in energy levels and the diseases resulting from them. A4- The balance between the oxidation process and the storage of biomolecules in the human body.
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.
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- 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 work in government and private pathological analysis laboratories

D3- 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
Short exams	Theoretical	**Biological membranes**	Biomembranes	2	**1**
Short exams	Theoretical	**Bioenergetics of carbohydrates**	Carbohydrate metabolic pathways and calculating the energy resulting from their oxidation	2	**2,3,4**
Short exams	Theoretical	**Metabolic pathways of lipids, Bioenergetics of lipids**	Fat metabolic pathways and their types and calculating the energy resulting from their oxidation	2	**5,6**
Short exams	Theoretical	**lipoprotein types, synthesis, transport, and function**	Types of protein fats, their synthesis, methods of transport and their function	2	**7**
Exams	Theoretical	**Protein metabolism: metabolism of important amino acid**	Protein metabolism: metabolism of important amino acids	2	**8**
Short exams	Theoretical	**Integration of metabolism**	Integration between metabolic pathways	2	**9**
Study and seminar exams	Theoretical	**Correlation between metabolic pathways and the function of human body organs**	The relationship between metabolic pathways and organ function in the human body	2	**10,11**
Short exams	Theoretical	**Types of fed state**	Types of nutritional states	2	**12**
Exams	Theoretical	**The function of bio organs during each type of fed state**	Functions of vital organs during each type of nutritional state	2	**13, 14**
		Clinical correlations	Relationships with clinical diseases	2	**15**

5. Infrastructure .5

Cample biology, 9th edition 2009. Jane B. Reece, Lisa A Urry, Micheal L. Cain.	1- Required textbooks

Biochemistry, 3th edition 2008. Mathews, Van Holde, Ahern	2- Main references (sources)
Lehninger Principles of Biochemistry, Fourth Edition 2010.	A) Recommended books and references (scientific journals, reports, etc.)
	B) Electronic references, Internet sites

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

Master's/First Course

Intermediates in organic chemistry mechanisms and stability

Course Description

Study of structures and mechanisms in organic chemistry, knowledge of preparation methods, comparis between them, and possible resulting compound

University of Baghdad	1. Educational institution
College of Science / Department of Chemistry	2. Academic department/center
Active Intermediates in Organic Chemistry Mechanisms and Stability	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)
2022/ **9/1**	7. Date this description was prepared
1. Course objectives: Teaching graduate students organic chemical reactions and chemical structures, knowing the structure of organic compounds, and how to explain the mechanism of organic reactions and their practical applications aimed at the scientific development of organic chemistry.	

9. Course outcomes, teaching, learning and assessment methods
A- Cognitive objectives A1- Identify the preparation of organic compounds A2- Preparation mechanisms 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- Reaching scientific thinking and deductive analysis of scientific information Teaching and learning methods 1- Direct explanation and delivery. 2- Using devices to estimate environmental factors. 3- Powerpoint presentation. And the screen.

4- Emphasizing the importance of the quality of scientific research and providing the opportunity for all scientists to document the latest scientific studies and discoveries through various sites currently available to our students

5- Explaining the lecture and discussion. Using presentations and urging the student to observe the working mechanism of all analytical techniques and how to model all models and how to deal with them for the purpose of analysis

Evaluation methods

1- Daily test and reports

2- Monthly tests

3- Final exams

4- Class discussions or during scientific and social lectures or through the international information network for the purpose of awareness for all scientific student groups and gaining flexibility in delivery and immediate response

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 chemical analysis laboratories

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

10. Course structure

Evaluation Method	Teaching method	Unit name/topic	Required learning outcomes	hours	We
Exams	Theoretical		Reactions & Mechanisms	6	1st & 2
Exams	Theoretical		**Chap.1/ Carbacation**	6	3rd &
Exams	Theoretical		**Chap.2/ Carbanion**	6	5th &
Exams	Theoretical		**Chap.3/ Free radicals**	6	7th &
Exams	Theoretical		**Chap.4/ α-,β- unsaturated carbonyl compounds**	6	9th & 1
Exams	Theoretical		**Chap.5/ Heterocyclic compounds**	6	11th & 1
Exams	Theoretical		**Chap.6/Poly aromatic hydrocarbons**	6	3rd & 1
			exam	3	1

11-Infrastructure

1-R.T.Morrisson and Boyd,"Organic chemistry ‘’,6th ed.paramountcommunication company 1992 **2- A.I.Vogel,'Text book of practical organic chemistry',3rd ed.,London1974** **3-J.Balfour,'Indigo ‘,British Museum Press1998**	6 Required Textbooks
Shriner,R.L.MorrillmT.C.Curtin D.Y.and Fuson C.,(The systematic identification of organic compounds),John Wile Sonic INC.United state ;8th edition 2004	7 Main References (Sources)
Silverstein Mr.M.Francis Mx.w.and David J.K.Spectroscopic identification of organic compounds.John Wily &Sonic INC.United	A) Recommended books and references (scientific journals, reports, etc
	.) B) Electronic references, Internet sites

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

Master's / First Course
Quantum chemistry and advance thermodynamics

Course Description

Study of the three basic laws of thermodynamics, conversion of work into thermal energy, isothermal and adiabatic processes, enthalpy and internal energy, spontaneous and non-spontaneous processes, the entropy and Kipps energy relationship, in addition to the laws of kinetic chemistry.

University of Baghdad	1. Educational Institution
College of Science / Department of Chemistry	2. University Department/Center
Quantum chemistry and advance thermodynamics	3. Course Name/Code
Weekly	4. Available Attendance Forms
First semester 2023-2022	5. Semester/Year
45 hours	6. Number of Study Hours (Total)
2022/ **9/1**	7. Date this Description was Prepared

1. Course Objectives

Modern chemistry relies entirely on quantum mechanics to understand the shapes of chemical systems and their interactions. This requires

Getting to know the nature of the kinetic problem in general and the applications of the quantized eigenvalue equation in its various aspects.

As well as getting to know the three basic laws of thermodynamics, conversions of work into thermal energy, isothermal and adiabatic processes, enthalpy and internal energy, spontaneous and non-spontaneous processes, the relationship of entropy and Kipps energy, in addition to the laws of kinetic chemistry.

10. Course structure

1. Learning outcomes, teaching and learning methods and assessment

Evaluation Method	Teaching method	Unit/Course or Topic Name	Required learning outcomes	hours	week
Exams	1- Paper lectures 2- Electronic screen	Chapter One Energy Curve Energy Supersurface	A- Cognitive objectives A1- Identify the effect of metallic elements on biological systems A2- Transport processes and enzyme movement A3- The effect of the geometric and electronic shape of elements on biological systems A4- Important properties of cofactors in metabolic processes B- Objectives Course-specific skills B1- Providing students with the special skills to know the problems that society suffers from, their causes, how they are distributed and the effect of different 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 higher education. Teaching and learning methods 1- Using the Google Class platform 2- Preparing reports and homework 3- Using YouTube explanatory videos 4- Using illustrative tools and asking inferential questions Evaluation methods 1- Monthly tests 2- Daily tests and discussions 3- Reports and homework C- Emotional and value objectives C1- Acquiring solid scientific methods to build the structure and structure of a successful scientific researcher to conduct analyses from a broad scientific point of view C2- Making the student look at the analysis of environmental samples and process the results from a broad scientific point of view. Teaching and learning methods Using the blackboard and display screen and displaying pictures, drawings and models and bringing illustrative models Evaluation methods - Monthly and daily written tests, oral discussions, reports, student activity in the lecture and attendance D- General and transferable qualification skills (other skills related to employability and personal development). D1- Encouraging students to rely on themselves and use the library. D2- Using the Internet to increase knowledge.	3	First
Exams	1- Paper lectures 2- Electronic screen	Energy curve Energy supersurface		3	Second
Exams	1- Paper lectures 2- Electronic screen	Chapter 2. Review of Classical Mechanics		3	Third
Exams	1- Paper lectures 2- Electronic screen	Chapter 2. Review of Classical Mechanics		3	Four
Exams	1- Paper lectures 2- Electronic screen	Chapter 3. Old Quantum Theory		3	Fif
Exams	1- Paper lectures 2- Electronic screen	Chapter 3. Old Quantum Theory		3	Six
Evaluation Method	1- Paper lectures 2- Electronic screen	Chapter 3. Old Quantum Theory		3	Seven
	1- Paper lectures 2- Electronic screen	Chapter 4. Quantum Mechanics		3	Eigh
	1- Paper lectures	Chapter 5. Wave Mechanics and Schrödinger's		3	Nin

	2- Electronic screen	Description of Quantum Mechanics			
	1- Paper lectures 2- Electronic screen	Introduction to Thermodynamic Chemistry		3	Ten
	1- Paper lectures 2- Electronic screen	Thermodynamic Laws		3	Eleven
	1- Paper lectures 2- Electronic screen	Gibbs Free Energy + Problem Solutions		3	Twelf
	1- Paper lectures 2- Electronic screen	Definition of Kinetic Chemistry		3	Thirteen
	1- Paper lectures 2- Electronic screen	Law of Kinetic Chemistry		3	Fourteen
	1- Paper lectures 2- Electronic screen	Problem Solutions		3	Fifteen

11. Infrastructure	
▪ Introduction to Quantum Mechanics by Professor Dr. Muthanna Abdul Jabbar Shanshal ▪ Questions and Solutions in Quantum Mechanics by Professor Dr. Rahab Majed Kabba	Required Textbooks
Essential of physical chemistry BOOK (Arun Bahl, G. D. Tuli) Chemical Thermodynamics of Materials (Svein Stølen, Neil L. Allan).	Main References (Sources)

Master's / Second Course / Inorganic Chemistry Specialization
Metal ions in living system

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
College of Science / Department of Chemistry	2. University Department/Center
Metal ions in living system / second semester	3. Course Name/Code
Students' names lists	4. Available Attendance Forms
Second 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

1. Course objectives

Study the basics of organic abiotic chemistry in the field of public health and pharmaceutical chemistry, which is concerned with studying the chemical components of living materials and the chemical changes that occur during vital processes of metabolism, growth and reproduction.

2. Learning outcomes, teaching and learning methods and evaluation

A- Knowledge and understanding

A1- Identify the effect of metallic elements on biological systems

A2- Transport processes and enzyme movement

A3- The effect of the geometric and electronic shape of elements on biological systems

A4- Important properties of cofactors in metabolic processes

B- Objectives and skills specific to the course

B1- Identify the latest scientific findings in the field of organic abiotic chemistry

Teaching and learning methods

1- Use PowerPoint

2- Prepare reports and homework

3- Use the board

4- Use illustrative means and ask inferential questions

Evaluation methods

1- Monthly tests

2- Daily tests and discussions

3- Reports Homework

Teaching and learning methods

Using the blackboard and the display screen and displaying pictures, drawings and models and bringing illustrative models

Evaluation methods

- Monthly and daily written tests, oral discussions, reports, student activity in the lecture and attendance

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

D1- Encouraging students to rely on sources and use the library

D2- Using the Internet for the purpose of increasing knowledge

Course structure .2

Evaluation method	Teaching method	Name of unit/course or topic	Required learning outcomes	Hours	week
Monthly exam, daily exam and discussion within the lecture	Using the whiteboard and PowerPoint	Introduction to Bioinorganic chemistry		3	1
Monthly exam, daily exam and discussion within the lecture	Using the whiteboard and PowerPoint	Role of metal ions in biological systems		3	2
Monthly exam, daily exam and discussion within the lecture	Using the whiteboard and PowerPoint	Essential and trace elements		3	3
Monthly exam, daily exam and discussion within the lecture	Using the whiteboard and PowerPoint	Basic principle and concepts and Thermodynamics complexes stability and site selectivity		3	4-5
Monthly exam, daily exam and discussion within the lecture	Using the whiteboard and PowerPoint	Properties important for catalysis and effect of metal environment created by protein		3	6-7

Monthly exam, daily exam and discussion within the lecture	Using the whiteboard and PowerPoint	Structure of metallo-protein		3	8
Monthly exam, daily exam and discussion within the lecture	Using the whiteboard and PowerPoint	Oxygen carriers		3	9
Monthly exam, daily exam and discussion within the lecture	Using the whiteboard and PowerPoint	Inorganic prosthetic group		3	10
Monthly exam, daily exam and discussion within the lecture	Using the whiteboard and PowerPoint	Electron transfer chain (cellular respiration)		3	11
Monthly exam, daily exam and discussion within the lecture	Using the whiteboard and PowerPoint	Metallo enzyme and Bohr effect and Homeostasis		3	12-13
Monthly exam, daily exam and discussion within the lecture	Using the whiteboard and PowerPoint	Photosynthesis and nitrogencycle		3	14-15
11. Infrastructure					
-principles of Bioinorganic chemistry by Stephen J.Lippard and Jeremy M.BERG				1- Required textbooks	
1-Metallo cofactors that Activate small Molecules with focus on bioinorganic chemistry structure and bonding by Martus W. Eibbe 2- Metallo biomolecules by W.K.B.P.M.weerawarnq 3-Modeling bioinorganic chemistry www.scm.com				2- Main references (sources)	

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.

Master's / Second Course / Inorganic Chemistry Specialization

Bron 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	University of Baghdad - College of Science
2. Academic department/center	Chemistry Department
3. Course name/code	Boron Chemistry
4. Available forms of attendance	Traditional Lecture + Power Point Lecture
5. Semester/year	Second Semester/ 2023-2022
6. Number of study hours (total)	3 theoretical hours per week
7. Date this description was prepared	2022/ **9/1**

3. Course objectives

The course aims to study the following main topics: Study of the properties of boron, extraction, isolation and purification of boron, study of boron compounds which include: borides, borines, carborenes, boron halides, boron-oxygen compounds, boron-nitrogen compounds. Study of applications of boron compounds

1. Course outcomes and teaching, learning and assessment methods

A-A Cognitive objectives.

A1- The student should be able to identify boron chemistry

A2- Identify boron compounds and their reactions

B- Program specific skill objectives:

B1- Identify some of the methods and experiments used to diagnose boron compounds

B2- Identify techniques in diagnosing boron compounds descriptively and quantitatively

Teaching and learning methods

1- Traditional lecture + Power Point lecture

2- Preparing reports and homework

Evaluation methods

1- Preparing reports and homework

2- Examinations

C- Emotional and value objectives

C1- Discussions

C2- Reports and homework

Course structure .4					
Evaluation method	Teaching method	Unit Name / or Topic	Required learning outcomes	hours	week
Exams Homework Attendance	Traditional Lecture + Power Point Lecture	Study of Boron Properties	**Occurrence and Properties**	3	**1**
Exams Homework Attendance	Traditional Lecture + Power Point Lecture	Study of Boron Properties	**Occurrence and Properties (continue)**	3	**2**
Exams Homework Attendance	Traditional Lecture + Power Point Lecture	Extraction , Isolation and Purification	**Extraction of Boron, Isolation and Purification**	3	**3**
Exams Homework Attendance	Traditional Lecture + Power Point Lecture	Extraction , Isolation and Purification	**Extraction of Boron, Isolation and Purification (continue)**	3	**4**
Exams Homework Attendance	Traditional Lecture + Power Point Lecture	Boron compounds	**Compounds of Boron Borides -a**	3	**5**
Exams Homework Attendance	Traditional Lecture + Power Point Lecture)	Boron compounds	**b-Boranes (Boron hydride)**	3	**6**
Exams Homework Attendance	Traditional Lecture + Power Point Lecture		exam	3	**7**
Exams Homework Attendance	Traditional Lecture + Power Point Lecture	Boron compounds	**Boranes (Boron hydride** continue	3	**8**
Exams Homework Attendance	Traditional Lecture + Power Point Lecture	Boron compounds	**Boranes (Boron hydride** continue	3	**9**
Exams Homework Attendance	Traditional Lecture + Power Point Lecture	Boron compounds Carboranes	c-Carboranes	3	**10**

Exams Homework Attendance	Traditional Lecture + Power Point Lecture	Boron compounds Boron Halides	d-Boron Halides	3	**11**
Exams Homework Attendance	Traditional Lecture + Power Point Lecture	e-Boron – Oxygen Compounds	e-Boron – Oxygen Compounds	3	**12**
Exams Homework Attendance	Traditional Lecture + Power Point Lecture	f-Boron – Nitrogen Compounds	f-Boron – Nitrogen Compounds	3	**13**
Exams Homework Attendance	Traditional Lecture + Power Point Lecture	Applications	g- other compounds of boron, Uses and Applications	3	14
			exam	3	15

1. Infrastructure	
	1- Required textbooks
1-Whitten,Davis,Peck, Stanely, General chemistry, 7th Ed. , Brooks/ Cole, Thomson, (2003) **2**- Martin van Duin,'BORATE ESTERS: IDENTIFICATION, STRUCTURE, STABILITY, AND CATION COORDINATING ABILITY' Delft University Press, 1986. **3**-G.L.Miessler and D.A.Tarr , Inorganic chemistry . 2nd Ed, Prentice Hall, Upper Saddle , River, NJ, (1999**)** 4-F.A.Cotton and G.Wilkinson Basic inorganic chemistry.3rdEd,Wiley New york, (1995)	2- Main references (sources)

5- N.N.Greenwood and A.Earnshaw , Chemistry of elements, (1999)	
1-Chemistry of elements 2-Chemistry of boron 3-Inorganic chemistry	A) Recommended books and references (scientific journals, reports, etc.) B) Electronic references, websites, etc.
Electronic references were used.	A) Recommended books and references (scientific journals, reports, etc.) B) Electronic references, websites, etc.

1. 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.

Master's / Second Course
Specialization: Inorganic Chemistry

Electronic spectra of inorganic compounds

Course Description

	Study of the electronic spectra of inorganic complexes, starting with the study of electromagnetic radiation and its properties, the colours of inorganic compounds and their complexes, and the species responsible for colour.
University of Baghdad	1. Educational Institution
College of Science / Department of Chemistry	2. University Department/Center
Electronic spectra of inorganic compounds	3. Course Name/Code
Weekly	4. Available Attendance Forms
Second semester 2023-2022	5. Semester/Year
45 hours	6. Number of Study Hours (Total)
1/9/2022	7. Date this Description was Prepared

1. Course objectives

This semester aims to shed light on the electronic spectra of inorganic complexes, starting with the study of electromagnetic radiation and its properties, the colors of inorganic compounds and their complexes, and the species responsible for color, in addition to studying the selection rules, state symbols, derivation of atomic states, Tanaba-Sokano diagrams for complexes, Oracle diagrams in the octahedral field, and studying infrared spectra, mass spectra, magnetic properties, and nuclear magnetic resonance spectra.

9. Course Outcomes, Teaching, Learning and Evaluation Methods

A- Cognitive Objectives

A1- Identify the nature of the bond between ions and ligands

A2- Identify the most important techniques used to diagnose complexes spectrally

B- Program Skills Objectives

B1- Apply the approved theories to describe complexes practically

B2- Use spectral devices to analyze complexes and interpret their spectra

Teaching and Learning Methods

1. Paper lectures and power point lectures
2. Electronic lectures using electronic programs (Google Meet, Google Classroom, Telegram).
3. Examples, questions and weekly discussions during the lecture.
4. Basic and modern scientific books.
5. Conducting seminars for students.

Evaluation Methods

1. Conducting exams through homework to encourage students to read lectures daily.
2. Conducting short exams during the lecture to encourage students to read the lectures on a daily basis.
3. Conducting continuous monthly exams.
4. Reports and research required from the student.

C- Emotional and value-based objectives

C1- Acquiring solid scientific methods to build the structure and structure of the successful scientific researcher to conduct analyses from a broad scientific point of view

C2- Making the student look at the analysis of environmental samples and processing the results from a broad scientific point of view.

Teaching and learning methods

1- Participation in conferences to highlight students' intellectual skills such as conferences - seminars - courses

2- Conducting various tests among students to develop and highlight their intellectual and research energies

3- Discussing students through research projects of biological, industrial and research importance

4- Teaching all students to publish in journals with a long history of uninterrupted publication and a broad base of subscribers within the general or precise specialization

5- Teaching on solid software with a high database to teach all students how to check plagiarism, for example

6- Learning how to identify the manifestations of fictitious and non-serious journals

7- Workshops, periodicals, software and websites)

Evaluation methods

Teaching all students to publish in journals with a long history of uninterrupted publication and a broad base of subscribers within the general or precise specialization

5- Teaching on solid software with a high database to teach all students how to check plagiarism, for example

6- Learning how to identify the manifestations of fictitious and non-serious journals

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

D1- Research leadership and publishing in reputable journals

D2- The art of composing and preparing lectures, delivery method and correspondence

D3- Opportunities for developing scientific research in the Arab world

D4- Flexible scientific development in dealing with all analytical and industrial devices, their mechanism of operation, calibration, repair of their faults and components, flexible dealing with these mechanisms and how to use them in wide-ranging analysis

And developing the student's mental abilities - Developing skill capabilities and dealing with field and laboratory environmental measurement devices.

10. Course structure

Evaluation method	Teaching method	Name of unit/course or topic	Required learning outcomes	hours	Week
Monthly exam, daily exam and discussion within the lecture	data show and white board	Electronic Spectra of Inorganic Complexes		**3**	First
Monthly exam, daily exam and discussion within the lecture	data show and white board	Derivation of Atomic States and State Symbols		**3**	Second
Monthly exam, daily exam and discussion within the lecture	data show and white board	Orcal and Tanabe Sukanno Diagrams for Octahedral Complexes		**3**	Third
Monthly exam, daily exam and	data show and white board	Coordination Theories and Complex Colors		**6**	Fourth

discussion within the lecture					
Monthly exam, daily exam and discussion within the lecture		Tetrahedral Coordination Compounds		**3**	Fifth
	data show and white board	Exam		**6**	Sixth
		Magnetic properties of complexes		**3**	Seventh
Monthly exam, daily exam and discussion within the lecture	data show and white board	Mass spectra of inorganic complexes		**3**	Eighth
Monthly exam, daily exam and discussion within the lecture	data show and white board	NMR spectra 1		**3**	Ninth
Monthly exam, daily exam and discussion within the lecture	data show and white board	NMR Spectra 2		**3**	Tenth
Monthly exam, daily exam and discussion within the lecture	data show and white board	Technical and Application Infrared Spectra of Inorganic Compounds1		**3**	Eleventh
Monthly exam, daily exam and discussion within the lecture	data show and white board	Technical and Application Infrared Spectra of Inorganic Compounds2		**6**	Twelfth

		Applications of Infrared Spectra			Thirteenth
Monthly exam, daily exam and discussion within the lecture	data show and white board	General Examples and Solutions		**3**	Fourteenth
		Exam		**3**	Fifteenth

11. Infrastructure	
-principles of Bioinorganic chemistry by Stephen J.Lippard and Jeremy M.BERG Textbook of inorganic chemistry vol.1,2,3,4,5	1- Required textbooks
1-Metallo cofactors that Activate small Molecules with focus on bioinorganic chemistry structure and bonding by Martus W. Eibbe 2- Metallo biomolecules by W.K.B.P.M.weerawarnq 3-Modeling bioinorganic chemistry www.scm.com	2- Main references (sources)
	Recommended books and references (scientific journals, reports, ...)
	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.

Master's / Second Course

Specialization: Inorganic Chemistry

Crown ethers and their complexes with transition metals ions

Course Description

Study of the basic concepts and scientific facts of the formation of crown compounds, methods of interpreting their formation, and preparation of complexes of metal crown ethers.

.1 Educational institution	University of Baghdad
.2 Academic department/center	College of Science / Chemistry
.3 Course name/code	Crown ethers and their complexes with transition metal ions
.4 Available forms of attendance	Weekly
.5 Semester/year	Second / 2023-2022
.6 Number of study hours (total)	45 hours
.7 Date this description was prepared	**1/9/2022**
.8 Course Objectives	
The student learns many basic concepts and scientific facts for the formation of crown compounds. The student learns methods for interpreting the formation of complexes for crown ethers. The student learns how to prepare complexes for metal crown ethers. The student learns to find some extracted and necessary data and analyze them to determine the identity of the prepared compounds. The student learns some applications to benefit from complexes or crown compounds.	

9. Course Outcomes, Teaching, Learning and Evaluation Methods

A- Cognitive Objectives

A1- Clarifying the basic concepts and theories on which the chemistry of crown compounds was built or founded through a set of concepts.

A2- Acquiring skills in dealing with the problem.

A3- Acquiring basic skills as an introduction to building and preparing crown compounds.

A4- Acquiring theoretical concepts for dealing with data and employing them in pre-prepared software to obtain information sufficient to reach knowledge of the compounds to be prepared according to scientific foundations.

B- Course Skill Objectives

B1- The ability to think about dealing with the problem according to specific rules by using the creative and deductive method or method and avoiding the rote and memorization method.

B2- Writing scientific reports.

B3- Teaching students various techniques

B4- Preparing chemical materials such as simple crown ether and then the higher composition.

Teaching and learning methods

Adopt blended learning (direct learning through the use of the board and the display screen in pdf and power point format using multiple programs that ensure fruitful communication between the teacher and the student).

Evaluation methods

- Readings, self-learning, discussion groups.
- Training and activities in the classroom.
- Guiding students to some websites to benefit from them to develop capabilities.
- Holding research seminars through which some problems are explained and analyzed and the mechanism for finding solutions to them.
- Conducting written tests and oral dialogues in almost every lecture.
- In addition to monthly exams and final exams.

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 distinction of chemical compounds.

C3- Enabling students to solve problems related to the intellectual framework of chemistry.

A4- Acquiring the skill of dealing ethically with participants in scientific research.

Teaching and learning methods

Using teaching methods that develop mental and creative thinking in students, transcending the traditional method (memorization and indoctrination).

Evaluation methods

- Assigning students to review what is published about the semester topic through the Internet.
- Urging students to borrow scientific sources from the department or college library to review the study topic.
- Opening horizons for the student to think about investing the prepared compounds in many fields that serve the community

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 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 the methods and tools based on research and the equipment used in chemistry in all specializations.

45 Course Structure					
Evaluation Method	**Teaching method**	**Unit name/topic**	**Required learning outcomes**	**hours**	**week**
Exams Homework Attendance	**Traditional lecture + power point lecture**	History of the formation of crown ethers		**3**	First
Exams Homework Attendance	**Traditional lecture + power point lecture**	Classification of the structure of crown ethers		**3**	Second
Exams Homework Attendance	**Traditional lecture + power point lecture**	Cont.		**3**	Third
Exams Homework Attendance	**Traditional lecture + power point lecture**	Properties of crown ethers		**3**	Fourth
Exams Homework Attendance	**Traditional lecture + power point lecture**	Cont.		**3**	Fifth
Exams Homework Attendance	**Traditional lecture + power point lecture**	Methods of preparation of ethers		**3**	Sixth
Exams Homework Attendance	**Traditional lecture + power point lecture**	Cont.		**3**	Seventh
Exams Homework Attendance	**Traditional lecture + power point lecture**	Naming of ethers		**3**	Eighth

Exams Homework Attendance	**Traditional lecture + power point lecture**	Cont.		**3**	Ninth
Exams Homework Attendance	**Traditional lecture + power point lecture**	Applications of crown ethers		**3**	Tenth
Exams Homework Attendance	**Traditional lecture + power point lecture**	Performing the first monthly exam		**3**	Eleventh
Exams Homework Attendance	**Traditional lecture + power point lecture**	Complexes of crown ether metals, their preparation		**3**	Twelfth
Exams Homework Attendance	**Traditional lecture + power point lecture**	Cont.		**3**	Thirteenth
Exams Homework Attendance	**Traditional lecture + power point lecture**	Stability of crown ethers		**3**	Fourteenth
Exams Homework Attendance	**Traditional lecture + power point lecture**	Theoretical studies: The purpose of them... Theoretically preparing crown ethers and their complexes		**3**	Fifteenth

	45 Infrastructure
1. Inorganic Chemistry, J. E. Huheey, E. A.Keiter, R. L. Keiter,(4th edn.), 1993 2. Basic Inorganic Chemistry, E. A. Cotton, G. Wilkinson, (3rd edn.) 1995, Wiley interns Edition	45 Required textbooks
1. Inorganic Chemistry, J. E. Huheey, E. A.Keiter, R. L. Keiter,(4th edn.), 1993	46 Main references (sources)
2. Basic Inorganic Chemistry, E. A. Cotton, G. Wilkinson, (3rd edn.) 1995, Wiley interns Edition	A) Recommended books and references (scientific journals, reports, etc.)
Scientific journals, periodicals and research in the specialty.	B) Electronic references, Internet sites.

Websites, Google, YouTube and social media in the specialty.	45 Infrastructure

45 Curriculum Development Plan
- Developing the curriculum content by deleting, adding and replacing according to administrative procedures. - Using modern teaching methods according to the nature of the subject and the level of learners from time to time. - Using modern assessment tools that the student interacts with and at the same time keeps him away from the atmosphere of boredom and repetition. - Field visits to some scientific research institutions related to the subject of the curriculum to consolidate what is learned in the semester and to see the methods directly in person.

Master's degree / Second course / Physical Chemistry specialization

Surface phenomena and heterogeneous catalysis

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
College of Science / Department of Chemistry	2. Academic department/ center
Surface phenomena and heterogeneous catalysis	3. Course name/code
Scientific lecture	4. Available forms of attendance
Second semester 2023-2022	5. Semester/year

3	6. Number of study hours (total)
1/9/2022	7. Date this description was prepared
Course Objectives Study surface chemistry and adsorption processes that occur on the surface and the mechanics by which materials are adsorbed, as well as study the various auxiliary factors and their role in increasing the kinetics of the adsorbent. 6. Course Outcomes and Teaching, Learning and Evaluation Methods A- Cognitive Objectives. A1- Enabling students to gain knowledge and understanding of the intellectual framework of chemistry A2- Enabling students to gain knowledge and understanding of international chemical standards A3- Enabling students to gain knowledge and understanding of the laws of chemistry A4- Enabling students to gain knowledge and understanding of the standards of chemical analysis A5- Enabling students to gain knowledge and	

understanding of the law of misuse of chemicals
A6- Enabling students to gain knowledge and understanding of chemistry systems
Enabling students to gain knowledge and understanding of chemistry in English

B- Course specific skill objectives
B1- Scientific and practical skills
B2- Recollection and analysis skills
B3- Use and development skills
Evaluation methods
Daily tests with multiple-choice questions for academic subjects
- Participation grades for difficult competitive questions for students
- Setting grades for assigned homework
- Qualitative and quantitative practical tests in laboratories
C- Emotional and value objectives
C- Thinking skills and scientific problem-solving skills
C1- Enabling students to solve problems related to In the intellectual framework of chemistry
Part 2 - Enabling students to solve

problems related to international chemistry standards
Part 3 - Enabling students to solve problems related to the laws of control and quality of chemistry
Part 4 - Enabling students to solve problems related to chemistry and in the English language
Teaching and learning methods
Providing students with the basics and additional topics related to the previous educational outcomes of problem-solving skills
Scientific
- Solving a set of practical examples by the academic staff
- Asking students during the lecture to solve some scientific issues
Evaluation methods
- Daily exams with multiple-choice questions that require scientific skills
- Daily exams with scientific and practical questions
- Participation grades for competition questions for academic topics
- Setting grades for homework

- Assigning students to do scientific seminars and discuss them D - General and transferable qualification skills (other skills related to employability and personal development). D1 - Enable students to think and analyze topics related to the intellectual framework and international chemical standards D2 - Enable students to think and analyze topics related to company laws and chemical audit standards D3 - Enable students to think and analyze topics related to language systems for importing chemicals D4 - Enable students to think and analyze topics related to chemistry in English

5. Course structure

Evaluation Method	Teaching Method	Unit name/topic	Required Learning Outcomes	hours	Week
Daily and Monthly Exams	Paper Lectures	Surface chemistry , Adsorption , Type of adsorption , Mechanism of adsorption , Energies of adsorption	Surface Chemistry Concepts and Adsorption Mechanisms	**3**	**1**
Daily and Monthly Exams	Paper Lectures	Potential energy of diagram of adsorption chemisorptions ,	Recognize the Potential Curve for Physical and Chemical Adsorption	**3**	**2**

		Localized and non localized adsorption , Type of desorption			
Daily and Monthly Exams	Paper Lectures	Kinetics of adsorption and desorption , Rate of desorption , Factors effecting the extent of adsorption	Study the Mechanism of Adsorption and Adsorption	**3**	**3**
Daily and Monthly Exams	Paper Lectures	The Langmuir surface balance , Adsorption isotherm , Langmuir adsorption isotherm , Kinetics of surface reaction	Isotherm Adsorption	**3**	**4**
Daily and Monthly Exams	Paper Lectures	BET isotherm , Calculation the surface area of the adsorbent , Temkin adsorption isotherm , Dubinin – radushkevich isotherm	Calculate the Surface Area and Study Different Types of Adsorption	**3**	**5**
Daily and Monthly Exams	Paper Lectures	Type of adsorbents , Surfaces used for study the adsopting , adsorption from solution , Heat of adsorption	Types of Surfaces Used in Adsorption Study	**3**	**6**
Daily and Monthly Exams	Paper Lectures	Thermal desorption spectra , Apparatus using for study the desorption , Incorporation , Isotope exchange, Applications of adsorption	Thermal Adsorption Spectrum and Devices Used in the Adsorption Process	**3**	**7**
Daily and Monthly Exams	Paper Lectures	Kinetics modeling , Adsorption thermodynamics	Thermodynamics and Kinetics of Adsorption	**3**	**8**
Daily and Monthly Exams	Paper Lectures	Techniques used for the characterization of	Techniques Used in Surface Diagnosis	**3**	**9**

		surfaces , a/ Photo emission spectroscopy , b/ Secondary – ion mass spectrometry			
Daily and Monthly Exams	Paper Lectures	Low – energy electron diffraction , Electrical conductivity	Low Energy Electron Deflection	**3**	**10**
Daily and Monthly Exams	Paper Lectures	Catalysis , Characteristics of catalysis , Classification of solid catalysts	Study of Catalysts, Their Properties and Classification	**3**	**11**
Daily and Monthly Exams	Paper Lectures	The specific nature of heterogeneous , Type of crystal defects	Specificity of Heterogeneous Catalysts and Study of Crystalline Defects	**3**	**12**
Daily and Monthly Exams	Paper Lectures	Type of catalysis , Heterogeneous catalysis , Stepwise mechanism of surface reaction	Types of Heterogeneous Catalysts	**3**	**13**
Daily and Monthly Exams	Paper Lectures	Theory of catalysis , Inhibition by products , Active centers , Poisoning of catalysts , 1/ Sintering , 2/ Fouling , 3/ promoter , 4/ supports	Adsorption Theories	**3**	**14**
Evaluation Method	Paper Lectures	chemisorptions and catalysis by metals , Kinetics of catalyzed reactions , Orders of reactions	Kinetics of catalyzed reactions and study of reaction order	**3**	**15**

1. Infrastructure

1- Required textbooks	.1 Adsorption, Surface area, and porosity Gregg, S.J. and Sing, K.S.W .2 Heterogeneous Catalysis principles and applications G.C.Bond
2- Special requirements (including, for example, workshops, periodicals, software, and websites)	
a) Social services (including, for example, guest lectures, vocational training, and field studies)	Student participation in continuing education lectures online
b) Electronic references, websites, ...	YouTube, Google

1. Curriculum development plan
Study of surface chemistry, adsorption processes occurring on the surface, and the mechanics by which materials are adsorbed, as well as study of various auxiliary factors and their role in increasing adsorption kinetics.

ماجستير /الكورس الثاني
Master's / Second Course
Specialization: Physical Chemistry
Nano identification techniques

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
Nano Detection Technologies	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

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-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- 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**	**Unit name/topic**	**Required learning outcomes**	**hours**	**Week**
Daily and Monthly Exams and Seminar	Power point	**nanochemistry**	Concepts of nanochemistry Definitions, classifications, properties, preparation approaches Applications, Historical events	**6**	**1-2**
Daily and Monthly Exams and Seminar	Power point		Introduction to the nano identification techniques	**6**	**3-4**
Daily and Monthly Exams and Seminar	Power point		x - ray diffraction (XRD)	**6**	**5-6**
Daily and Monthly Exams and Seminar	Power point		Electron microscopy (EM) A-scanning electron microscopy (SEM)	**6**	**7-8**

			Components, types of detectors B-transmission electron microscopy (TEM)		
Daily and Monthly Exams and Seminar	Power point		scanning probe microscopy (SPM) A-Atomic force microscopy (AFM) Types of tips, Contact mode, tapping mode B-scanning tunneling microscopy (STM)	**6**	**9-10**
Daily and Monthly Exams and Seminar	Power point		Nano Indentation	**6**	**11-12**
Daily and Monthly Exams and Seminar	Power point		Image processing software (Image	**3**	**13-14**
Evaluation Method	Power point		**Exam**	**3**	**15**

11. Infrastructure	
	1- Required textbooks
1- Concept of nanochemistry 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 the scientific material Using modern technologies

Master / Second Course
Specialization: Physical Chemistry
Corrosion 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 program description..

University of Baghdad / College of Science	1. Educational institution
Chemistry Department	2. Academic department/center
Corrosion Chemistry / Master / Second Course	3. Course name/code
Electronic Name Lists	4. Available forms of attendance
First Semester / 2023-2022	5. Semester/year
3 Theoretical Hours Weekly	6. Number of study hours (total)

1/9/2022	7. Date this description was prepared

Course objectives

1. The course aims to: identify the types of corrosion, methods of reducing it, methods of estimating it, and modern techniques used in measurement and identifying the negative and positive conditions capable of affecting corrosion rates. 2. Course Outcomes, Teaching, Learning and Evaluation Methods

A- Cognitive Objectives

A1- Types of alloys and how to improve their resistance

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

A3- Using organic and organic inhibitors

A4- Understanding the negative state of metals used in industry

A5- Understanding the related electrical theories

A6- Studying corrosion thermodynamics

B- Course Skill Objectives

B1- Reducing corrosion

B2- Guessing which alloys are suitable for each solution according to the Burbex curves

B3- Choosing the appropriate conditions of temperature and stirring speed

B4- Identifying inhibitors of their types and which one is most appropriate

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 objectives

C1- Thinking about the causes of corrosion

C2- Determining the optimal conditions for increasing the life of the structure

C3- Choosing the appropriate way to reduce corrosion

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

5. Course structure

Evaluation Method	**Teaching method**	**Name of unit/course or topic**	Required Learning Outcomes	**hours**	Week
Daily and Monthly Exams and Seminar	**Power point**	**Electrochemical Aspect.**	Causes of Corrosion	**3**	First week

		Electrochemical reactions & corrosion			
Daily and Monthly Exams and Seminar	**Power point**	**Polarization &passivity**	Polarization and Negativity	**3**	Second week
Daily and Monthly Exams and Seminar	**Power point**	**-Environment effects -Effect of oxygen & oxidizers**	Effects on Corrosion Rate	**3**	Third week
Daily and Monthly Exams and Seminar	**Power point**	**Effect of velocity & temperature -Galvanic coupling**	Effects on Corrosion Rate	**3**	Fourth week
Daily and Monthly Exams and Seminar	**Power point**	**-Metallurgical aspects -EMF &galvanic series**	Mining	**3**	Fifth and sixth week
Daily and Monthly Exams and Seminar	**Power point**	**-Autocatalytic nature of pitting -Methods of prevention**	Electromotive Force Table	**3**	Seventh and eighth week
Daily and Monthly Exams and Seminar	**Power point**	**-Carbon steel , Iron & Stainless steel -Inhibitors classification**	Pitting Corrosion and Methods of Measuring It	**3**	**Week 9**
Daily and Monthly Exams and Seminar	**Power point**	**-Cathodic and anodic protection -coating classification**	Types of Steel	**3**	**Week 10 Week 11**
Daily and Monthly Exams and Seminar	**Power point**	**Modern theory & application – Corrosion Rate**	Classification of Inhibitors	**3**	**Week 12 Week 13**
Evaluation Method	**Power point**	**measurements Tafel extrapolation & Linear polarization**	Mechanism of Action of Each Inhibitor	**3**	**Week 14 Week 15**

		-Compensations effect			

	1. Infrastructure
Physical Chemistry text book	1- Required textbooks
	2- Main references (sources)
Modern Electrochemistry	a) Recommended books and references (scientific journals, reports, ...)
	b) Electronic references, Internet sites

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

Master's / Second Course

Specialization: Physical Chemistry

Avanced photochemistry

Course Description

Study of biological interactions in living organisms and natural phenomena such as photosynthesis, the effect of light on genetic factors, and the conversion and preservation of solar energy. .

University of Baghdad	1. Educational institution
College of Science / Department of Chemistry	2. Academic department/center
Advanced Photochemistry	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	
Photochemistry is the applied field of absorption of electromagnetic radiation by an atom or molecule in the ultraviolet and visible regions. The subject of photochemistry contributes to the following: 1- Understanding biological reactions in living organisms. 2- Understanding many natural phenomena such as the phenomenon of photosynthesis. 3- The effect of light on genetic factors. 4- Converting and storing solar energy.	

.. Course outcomes, teaching, learning and assessment methods9

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-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- 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	Unit name/topic	Required learning outcomes	hours	week
Daily and monthly exams and seminars	Power point	. Introduction	Theory Spectroscopy	**3**	**1**
Daily and monthly exams and seminars	Power point		Classification of methods Type of radiation energy	**3**	**2**
Daily and monthly exams and seminars	Power point		Regions of the spectrum Spectral parametars and their units	**6**	**3-4**
Daily and monthly exams and seminars	Power point		. Energy of radiation Nature of the interaction	**3**	**5**
Daily and monthly exams and seminars	Power point		What happens when radiation hits a molecule	**3**	**6**
Daily and monthly	Power point		Scattering Absorption	**3**	**7**

exams and seminars					
Daily and monthly exams and seminars	Power point		Type of material (atoms, molecules, crystals and extended materials, nuclei) Applications and history. Photochemistry Definition	**3**	**8**
Daily and monthly exams and seminars	Power point		Nature of light (the wave theory, the quantum theory) Laws of absorption of light Draper and Grothus law.	**3**	**9**
Daily and monthly exams and seminars	Power point		Stark and Einstein Lamberts Beers law. Quantum yields of photochemical reactions. The characteristics of electronic transitions	**3**	**10**
Daily and monthly exams and seminars	Power point		The Frank – Condon principles, and Frank – Condon factors. Specific types of transition – d transition. Vibronic transitions.	**3**	**11**
Daily and monthly exams and seminars	Power point		Charge transfer transitions transitions. The fates of electronically excited states.	**3**	**12**
Daily and monthly exams and seminars	Power point		Dissociation and pre-dissociation. Ionization. . Luminescence; re-emission of photon.	**3**	**13**
Daily and monthly exams and seminars	Power point		Flourescence. Phosphorescence. Intra and inter – molecular energy transfer. Quenching and sensitization.	**3**	**14**
Daily and monthly	Power point		**Exam**	**3**	**15**

exams and seminars					

11. Infrastructure	
1- Spectrum - 1985 Written by Dr. Laila Mohammed **2- Foundations of Photochemistry and Lasers - 2002 Written by Dr. Ali Abdul Hussein** **3- Physical Chemistry - Photochemistry - 1986 Written by Dr. Ali Abdul Hussein and Dr. Safaa Al-Omar**	1- Required textbooks
Photochemistry by R.B.Cundall and A .Gilbert,1970 -1 **Principles of Photochemistry by P.Snppun – London : The Chemical Society , 1973** -2	2- Main references (sources)
	3- Recommended books and references (scientific journals, reports, ...)
	4- Electronic references, Internet sites

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

Master's / Second Course
Specialization: Organic Chemistry
Chemistry of the Sulfur

Course Description

Study of structures and mechanics in organic chemistry, knowledge of preparation methods, compari between them, and the possible resulting compour

1. Educational institution	University of Baghdad
2. Academic department/center	College of Science / Department of Chemistry
3. Course name/code	Chemistry of the Sulfur
4. Available forms of attendance	Weekly
5. Semester/year	First Semester / 2022-2023

45 hours	6. Number of study hours (total)
1/9/2022	7. Date this description was prepared

1. Course objectives

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
1. 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- Course 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 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 work in government chemical analysis laboratories

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

					1. Course structur
Evaluation method	**Teaching method**	**Unit name/topic**	**Required learning outcomes**	**hours**	**wee**
Exams	Theoretical	Thiols compounds	Types of thiol compounds	**3**	
Exams	Theoretical	Thiols compounds synthesis	Methods of preparing thiol compounds	**3**	S
Exams	Theoretical	Thiols compounds mechanisms	Mechanics of preparing thiol compounds	**3**	
Exams	Theoretical	Thiols compounds identifications	Methods of diagnosis	**3**	F
Exams	Theoretical	Sulfide compounds	Types of sulfide compounds and methods of preparation	**3**	
Exams	Theoretical	Sulfide compounds mechanism	Mechanics of preparing sulfide compounds	**3**	
Exams	Theoretical	Sulfoxides compounds	Methods of preparing sulfoxide compounds	**3**	Se
Exams	Theoretical	Sulfoxides compounds	Mechanics of preparing them	**3**	F
Exams	Theoretical	Sulfoxides compounds	Diagnosis	**3**	
Exams	Theoretical	Sulfones compoundes synthesis	Types of sulfonate compounds	**3**	
Exams	Theoretical	Sulfones compoundes mechanism	Mechanics of preparing them	**3**	Ele
Exams	Theoretical	Sulfones compoundes identification	Diagnosis	**3**	Tv
Exams	Theoretical	Sulfonum compounds synthesis	Sulfonium compounds	**3**	Thir
Exams	Theoretical	Sulfonum compounds mechanism	Mechanics of preparing them	**3**	Four
			Semester exam		Fif

	1. Infrastructure
	6 Required textbooks
Mechanism and structure in organic chemistry **Edwin S .Gould**	7 Main references (sources)
A Guide to the Mechanism of Organic Reactions **Dr. Fadhel Suleiman Kamouna**	a) Recommended books and references (scientific journals, reports, etc.)
	b) Electronic references, websites

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

Master's / Second Course / Organic Chemistry

Natural products 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 available learning opportunities. It must be linked to the programme description.

University of Baghdad - College of Science - Department of Chemistry	1. Educational institution
Department of Chemistry	2. Academic department/center
Natural products chemistry	3. Course name/code
Natural products chemistry - Postgraduate studies - Master's	4. Available forms of attendance
Electronic presence	5. Semester/year
2023-2022	6. Number of study hours (total)
45 hours, three hours per week	7. Date this description was prepared

.**Course objectives:**

Teaching postgraduate students the basics and concepts of chemistry, natural products, 1. studying their formation and mechanisms of reactions in nature, the foundations and methods of their isolation, as well as studying the stereochemistry of natural product compounds. Opening new horizons by presenting some concepts in new 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 experiences a traditional lecture environment with the same discussion methods by asking questions and the professor answering, ensuring the integration of the foundations of a successful lecture

.

1. Course Outcomes, Teaching, Learning and Evaluation Methods

A- Cognitive Objectives

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

A2- To prepare the student to comprehend and prepare for the topics in the subsequent stages

A3- To teach and train the student to solve the exercises by following a special mechanism

A4- To instill confidence in the students and encourage them to engage in 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 by conducting short exams outside the time allocated for the lecture

B- Course specific 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 by using 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 objectives

C1- The student understands the university behavior that must be demonstrated

C2- Cultivating a spirit of cooperation among students, by the learner providing assistance to his friends in the classroom or doing group work in the classroom

C3- Developing some interests and hobbies among students

C4- Sensing the harms of smoking and drugs on health and society

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 ASSIGNMENTS As well as conducting monthly exams with a pre-determined date, as well as writing reports on organic chemistry and the topics that were given.

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 for preparing highly specialized cadres while developing their scientific and practical capabilities.

D3- Communicating with graduate students to know the lessons they 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

Course structure .1

Evaluation method	Teaching method	Unit name/topic	Required learning outcomes	hours	week
Short exams, monthly exams and oral discussions	Electronic - Visual video lectures	Chemistry of natural products	Purification, isolation of natural products	3	1
Short exams, monthly exams and oral discussions	Electronic - Visual video lectures	Chemistry of natural products	Terpenes: sesquiterpenes	3	1
Short exams, monthly exams and oral discussions	Electronic - Visual video lectures	Chemistry of natural products	monoterpenes	3	1
Short exams, monthly exams and oral discussions	Electronic - Visual video lectures	Chemistry of natural products	Diterpenes and sesterterpenes	3	1
Short exams, monthly exams and oral discussions	Electronic - Visual video lectures	Chemistry of natural products	alkaloids	3	1

1. Infrastructure

Medicinal chemistry of natural products, Paul S.	1- Required textbooks
Comprehensive of natural products ,	2- Main references (sources)

Christenson J.	
- Principles of organic chemistry, Salmon - Organic letters, UK reports	a) Recommended books and references (scientific journals, reports, ...)
https://ar.wikipedia.org/wiki/%D9%83%D9%8A%D9%85%D9%8A%D8%A7%D8	b) Electronic references, websites, ...

1. 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

Master's / Second Course

Specialization: Organic Chemistry **sterochemistery**

Course Description

This course covers the concepts of (sterochemistry). One of the options below is chosen according to the subject specialization and the rest is deleted.

University of Baghdad	Educational Institution
College of Science / Department of Biotechnology	Department/Center
Stereochemistry	Course Name/Code
Weekly	Available Attendance Forms
Second Semester 2023-2022	Semester/Year
45 hours	Number of Study Hours (Total)
1/9/2022	Date of Preparation of this Description

Course objectives

A- Expanding students' awareness to learn about modern technologies adopted globally. B- Contributing to preparing students' sound scientific thinking to solve obstacles in the fields of scientific research. C- Providing the labor market with graduates with experience and competence in the applied fields of biotechnology. Course outcomes, teaching, learning and evaluation methods. Cognitive objectives. A1- Enabling students to gain knowledge and understanding of the intellectual framework of the foundations and applications of biotechnology
A2- Enabling students to gain knowledge and understanding of industrial, pharmaceutical and food stereochemistry

B- Program specific skill objectives:
B1- Scientific and practical skills
B2- Recall and analysis skills
B3- Use and development skills

Teaching and learning methods

Providing students with the basics and topics related to knowledge and systems explained in:
1- Clarifying and explaining the study materials by the academic staff through the whiteboard and using PowerPoint using LCD and Data show screens
2- Providing students with knowledge through homework assignments for the study vocabulary
3- Asking students to visit the library to obtain academic knowledge related to the study vocabulary
4- Improving students' skills by visiting websites to obtain additional knowledge of the study materials

5- Brainstorming during the lecture
Evaluation methods
Daily tests with multiple-choice questions for the study materials
- Participation grades Difficult competitive questions for students
- Setting grades for assigned homework
- Qualitative and quantitative practical tests in laboratories

C- Emotional and value objectives
C 1 - Enabling students to solve problems related to the intellectual framework of the foundations and applications of biotechnology
C 2 - Enabling students to solve problems related to industrial, environmental and food microbiology
C 3 - Enabling students to solve problems related to microbial pathology, immunology, cell science and genetic engineering
C 4 - Enabling students to solve problems related to animal and plant tissue science

Teaching and learning methods

Providing students with the basics and additional topics related to previous educational outcomes for problem-solving skills

Scientific

- Solving a set of practical examples by the academic staff

Student participation during the lecture to solve some scientific issues

Evaluation methods

- Daily exams with multiple-choice questions that require scientific skills

- Daily exams with scientific and practical questions

- Participation grades for questions Competition for academic topics
- Setting grades for homework
- Assigning students to do scientific seminars and discuss them

D - General and transferable qualification skills (other skills related to employability and personal development).
D1 - Enabling students to think and analyze topics related to the intellectual framework and standards of the foundations and applications of stereochemistry
D2 - Enabling students to think and analyze topics related to the laws of stereochemistry
D3 - Enabling students to think and analyze topics related to language systems for importing chemicals
D4 - Enabling students to think and analyze topics related to stereochemistry in English
Teaching and learning methods

- Providing students with the basics and additional topics related to stereochemistry thinking and analysis outcomes
- Forming discussion groups during lectures to discuss stereochemistry topics that require thinking and analysis
- Asking students to ask a set of thinking questions during lectures such as what, how, when and why
for specific topics
- Giving students homework that requires self-explanations in causal ways
Evaluation methods
- Daily exams with self-solved homework questions
- Participation grades for competitive questions related to the subject matter
- Specific grades for homework

Stereochemistry / Theoretical Course Structure					
Evaluation method	**Teaching method**	**Unit name/topic**	**Required learning outcomes**	**hours**	**week**
امتحانات يومية واسبوعية وفصلية ونهائية	1-Paper lectures 2-Standard models 3-Video lectures	**Chail molecules Isomerism Enantiomers and chiral molecules**	Study of molecules and isomers	**3**	**1**
امتحانات يومية واسبوعية وفصلية ونهائية	1-Paper lectures 2-Standard models 3-Video lectures	**The biological importance of chirality The historical origin of strochemistry Test of chaility Nomenclature of Enantiomers**	Importance of chirality and methods of naming	**3**	**2**
امتحانات يومية واسبوعية وفصلية ونهائية	1-Paper lectures 2-Standard models 3-Video lectures	**Properties of Enantiomers: The origin of optical activity**	Properties of ensomers Optical properties and importance	**3**	**3**
امتحانات يومية واسبوعية وفصلية ونهائية	1-Paper lectures 2-Standard models 3-Video lectures	**Synthesis of chiral molecules chiral drugs**	Synthesis of chiral molecules	**3**	**4**

امتحانات يومية واسبوعية وفصلية ونهائية	1-Paper lectures 2-Standard models 3-Video lectures	**Molecules with more than one stereocenter**	Stereochemistry of drug efficacy	**3**	**5**
امتحانات يومية واسبوعية وفصلية ونهائية	1-Paper lectures 2-Standard models 3-Video lectures	**Extended and Fischer projection formulas**	Complex molecules containing more than one chiral center	**3**	**6**
امتحانات يومية واسبوعية وفصلية ونهائية	1-Paper lectures 2-Standard models 3-Video lectures	**Steroisomerism of cyclic compounds**	How to convert from one model to another when writing and drawing the compound	**3**	**7**
امتحانات يومية واسبوعية وفصلية ونهائية	1-Paper lectures 2-Standard models 3-Video lectures	**Relating conformations through reactions in which no bonds to the sterocenter are broken**	Stereochemistry of cyclic compounds	**3**	**8**
امتحانات يومية واسبوعية وفصلية ونهائية	1-Paper lectures 2-Standard models 3-Video lectures	**Sepration of enantiomers: Resolution**	Effect of positions during reactions that do not include breaking the bonds of the chiral center	**3**	**9**
امتحانات يومية واسبوعية وفصلية ونهائية	1-Paper lectures 2-Standard models 3-Video lectures	**Compounds with sterocenters other than carbon**	Ensomers and their separation	**3**	**10**
امتحانات يومية واسبوعية وفصلية ونهائية	1-Paper lectures 2-Standard models 3-Video lectures	**Chail molecules that do not possess a Tetrahedral atom with four different groups**	Compounds containing active centers other than carbon atoms	**3**	**11**
امتحانات يومية واسبوعية وفصلية ونهائية	1-Paper lectures 2-Standard models	**The biological of importance of chirality**	Chiral molecules that do not contain four different groups	**3**	**12**

	3-Video lectures				
امتحانات يومية واسبوعية وفصلية ونهائية	1-Paper lectures 2-Standard models 3-Video lectures	**Stereochemistry of organic reactions With examples(addition subsititution elimination reactions)**	Biological importance of chiral compounds	**3**	**13**
امتحانات يومية واسبوعية وفصلية ونهائية	1-Paper lectures 2-Standard models 3-Video lectures	**Streoselective and stereospecific reactions**	Stereochemistry in organic reactions with examples of various reactions	**3**	**14**
امتحانات يومية واسبوعية وفصلية ونهائية	**1**1-Paper lectures 2-Standard models 3-Video lectures	**NMR sepectroscopy with practices problems**	Some selective and selective reactions	**3**	**15**

13. Infrastructure	
1-Organic chemistry By Graham Solomons and Graig Fryhle	1- Required textbooks
1-Advance Organic chemistry By Francis A Cary 2-Organic chemistry by Clayden ,Greeves ,Warren 3-Stereochemistry Workbook by Allan D. Dunn 123	1- Main references (sources)
Organic chemistry By Graham Solomons and Graig Fryhle	A- Recommended books and references
Many sites that deal with stereochemistry, including medical sites, YouTube, and scientific research.	(scientific journals, reports,.....)

1. Curriculum development plan
Follow up on internet references and research published in international journals as well as modern books, if available, to keep pace with the great development in stereochemistry.

Master's / Second Course

Specialization: Organic Chemistry

Spectrometric Identification of Organic Chemistry

Course Description

Study of structures and mechanisms in organic chemistry, knowledge of preparation methods, comparis between them, possible resulting compounds, and methods used to diagnose organic compound

University of Baghdad	1. Educational institution
College of Science / Department of Chemistry	2. Academic department/center
Spectrometric Identification of Organic Chemistry	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

1. Course objectives:

Teaching graduate students organic chemical reactions and chemical structures, knowing the structure of organic compounds, and how to explain the mechanism of organic reactions and their practical applications aimed at the scientific development of organic chemistry.

9-Course Outcomes, 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 Skills 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

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 work in government chemical analysis laboratories

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

10.بنية المقرر

Evaluation method	Teaching method	Unit name/topic	Required learning outcomes	hours	week
Exams	Theoretical	Chapter I: Ultraviolet Spectrometry		3	F
Exams	Theoretical	-Theory and Sample handling		3	Seco

Exams	Theoretical	-characteristic Absorption of Organic Compounds		3	Th
Exams	Theoretical	Chapter II: Infrared Spectrometry		3	Fou
Exams	Theoretical	-Theory and Sample handling		3	Fi
Exams	Theoretical	-Theory and Instrumentation		3	Si
Exams	Theoretical	- Sample handling		3	Seve
Exams	Theoretical	-Interpretation of Spectra		3	Eig
Exams	Theoretical	-characteristic group frequencies of Organic molecules		3	Ni
Exams	Theoretical	Chapter III: proton magnetic Resonance Spectrometry		3	Te
Exams	Theoretical	- Introduction and Theory		3	Eleve
Exams	Theoretical	-Apparatus and Sample handling		3	Twel
Exams	Theoretical	-Chemical Shift and Simple Spin-Spin Coupling		3	Thirtee
Exams	Theoretical	Chapter IV: 13C-NMR Spectrometry		3	Fourtee
Exams	Theoretical	Chapter V: Mass Spectrometry		3	Fiftee

	11-Infrastructure
1-R.T.Morrisson and Boyd,"Organic chemistry ‘’,6th ed.paramountcommunication company 1992 **2- A.I.Vogel,'Text book of practical organic chemistry',3rd ed.,London1974** **3-J.Balfour,'Indigo ‘,British Museum Press1998**	6 Required textbooks
Shriner,R.L.MorrillmT.C.Curtin D.Y.and Fuson C.,(The systematic identification of organic compounds),John Wile Sonic INC.United state ;8th edition 2004	7 Main references (sources)
Silverstein Mr.M.Francis Mx.w.and David J.K.Spectroscopic identification of organic compounds.John Wily &Sonic INC.United	a) Recommended books and references (scientific journals, reports, etc.)
	b) Electronic references, Internet sites

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

Master's / Second Course /
Specialization in Analytical Chemistry
Advanced Flow Injection Analysis

Academic program description

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

University of Baghdad\College of Science	1. Educational Institution
Chemistry	Academic Department/Center
Department of Chemistry	Name of Academic or Professional Program
Master of Chemistry	Name of Final Certificate
Semester / Advanced Flow Injection Analysis / Second Course	Academic System/Annual/Courses
2023-2022	Accredited Accreditation Program
Ministry of Higher Education and Scientific Research	Other External Influences
1\9\2022	Date of Preparation of this Description

Objectives of the Academic Program

The aim of teaching the Advanced Fluid Injection Analysis course / First Semester is to identify the basis of the work of continuous flow injection analysis and the advantages and wide modern applications of this modern technique in pharmaceutical chemistry, pharmaceutical analysis, and various estimates of drugs, transition elements, organic and inorganic groups, and amino acids with high accuracy, repeatability, and control, and low consumption of chemicals and organic reagents using advanced techniques in the field of flow injection, including microfluidic technology, LOV, and intermittent automation systems in the fields of medicine, automatic organic elemental analysis, and MULTI LAYERS FILM technology, in addition to other systems included under the STOP-FLow and 3FIA fluid injection analysis, and area integration and sequential analysis as recorded in the vocabulary

10- Course Outcomes, Teaching, Learning and Evaluation Methods

A- Cognitive Objectives

A1- Identify the advantages and characteristics of continuous flow injection analysis using different types of techniques that differ in the basis of work depending on either continuous or intermittent flow or flow - stop or sequential or microfluidic systems.

A2- Sensitivity and control of the flow injection analysis method and reaching results with high conformity and repeatability of the obtained results.

A3- Wide applications of the FIA technique in several fields including pharmaceutical estimates and industrial, environmental and biological models because the method is characterized by speed in estimation, simplicity and high modeling per hour compared to classical methods.

A4- Use modern statistics to process the results and how to use it and teach it to students and apply it to the obtained research results and prove the extent of the credibility and sensitivity of the proposed FIA method compared to the standard method using several statistical tests.

B - Course specific skill objectives

B1 - 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 new automatic systems used in several fields of applications and analysis.

B2 - Discovering new methods and new interactions for other estimates in conjunction with other analysis techniques such as using FIA technology as an analytical technique and sensing with selective electrodes or measuring turbidity or fluorescence, and thus it is possible to couple the FIA method with separation methods such as GC, HPLC solid phase extraction.

B3 - The possibility of manufacturing different injection valves (the method of injecting the sample into the measurement system) from plastic materials or Teflon or polypropylene at very low prices compared to expensive global valves. The innovative valve includes seven to eight chemicals in sizes up to microliters (lowest chemical consumption)

B4- The possibility of manufacturing microfluidic systems from Teflon tubes with internal diameters (0.5mm), rationing the consumption of expensive organic reagents.

Teaching and learning methods

1- Realistic lectures in classrooms

2- Create a channel on the Telegram program with master's students.

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

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

Evaluation Methods

As for the evaluation of the professors of the students through the monthly exams, the date of which is set in advance, the short exams in the classrooms, and the homework assignments that include video recordings explaining the mechanism of some devices and parts of some important chemical reactions electronically and are prepared by the students and are related to the topics of the assigned subject.
C- Emotional and value objectives
C1- Renewing the students' self-confidence from the 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.
C3- The professor's affection and respect for the student gives the student an effective incentive to work hard and raise his academic level.
C4- The student's awareness and understanding of the harms of smoking and drugs on health and society.
D- General and transferable qualification skills (other skills related to employability and personal development).
D1- Through the professor's positive relationship with the master's 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 affiliated 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.

The decision					
Evaluation method	Teaching method	Unit name/topic	The decision	Hours	week
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Introduction to flow injection (analysis (FIA	1 - Advantages and dis Advantages of automated analysis 2 - Types of automatic systems , Modern continuous flow analyzer	3	1
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	FIA advantages of FIA	1 – Instrumentation 2 - Sample and reagent transport system , injection	6	2-3

			valve and detectors , peristaltic		
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Separation in FIA	.1 – Dialysis 2- Gas diffusion and - Solvent extraction	6	4-5
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Dispersion (low medium , and dispersion Principles of FIA	1 - Types of FIA 2 - Stopped flow methods . - Reversal FIA -3 . 4 - Merging zones FIA . 5 - Sequential injection analysis	6	6-7
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Lab -on- a valve technology (LOV)	Micro Fluidic Systems (analyzer allows the analysis of DNA, RNA).	3	8
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Discrete Automatic systems	1-Automated sampling And sample definition of liquid and gases. 2-Robotics 3-Discrete clinical analyzers. 4-Automatic organic elemental analyzers.	9	9 10 11
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Analysis based upon multilayer films technology.	1-General principles ,film structures. 2- Instumentation. 3- Reflective photometer. 4- Potentiometry.	6	12-13
Weekly exams and monthly exams	1- Paper lectures 2- Electronic screen	Statistical treatment of analytical parameters.	Application of continuous flow injection analysis for determination of drugs, inorganic and organic species, vitamins.	6	14-15

12-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 networking 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).
13- 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.
14- The most important sources of information about the program
1- Ruzicka ,J and Hansen ,E.H,Flow injection analysis wiley and son Inc. , New York , 1981. 2-Hansen , E.H and Ruzicka , I.Retro – review of flow injection analysis .trend and .chem. , 2008. 3-principles of instrumental of analysis by skoog ,Holler and Niman 5th edition. 4 - principles of instrumental of analysis by skoog ,Holler and Grouch 6th edition . 5- fundamental of analytical chemistry by skoog ,west , Holler 6th edition .

Master's / Second Course
Specialization: Analytical Chemistry
Principles and Statistics of Ion Selective Electrodes

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	Educational Institution
Chemistry	1. Academic Department / Center
Principles and Statistics of Ion Selective Electrodes	Course Name / Code
In-person	Available Attendance Forms
Second Semester/2023-2022	Semester / Year
3 Hours	Number of Study Hours (Total)
1/9/2022	Date of Preparation of this Description
Course Objectives	
1- Students are introduced to the basics of selective electrode chemistry and their importance in chemical analysis is studied	
2- Students are taught the media in which selective electrodes work	
3- Students are taught to identify chemical materials using selective electrode technology	
4- Students are introduced to the types of selective electrodes	
5- Students are taught the applications of selective electrodes	

6- How to analyze a mixture of materials in the model

Course Outcomes, Teaching, Learning and Evaluation Methods
A- Cognitive Objectives
A1- Quantitative and qualitative determination of the material to be analyzed
A2- Learning the calculations necessary to know the quantity of the material to be analyzed
A3- Teaching students to know the correct method for determining the material to be analyzed

B- Course Skills Objectives
B1- Scientific and theoretical education in understanding the foundations of the principles and statistics of ion selective electrodes
B2- Scientific convergence between theoretical curricula and practical reality
B3- Finding appropriate statistical and analytical methods in how to determine and analyze chemical materials
B4-

C- Emotional and value objectives
C1- The student feels 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, which 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 a factor of scientific motivation
D4- Making the scientific institution the largest incubator for students, which generates a factor of belonging

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 give the student 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- Encouraging them to use scientific books to benefit from them scientifically. D2- Clarifying the future goals of the students, which generates the scientific motivation factor. D3- Making the scientific institution the largest incubator for the students, which generates the sense of belonging.

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	Membrane Potential Theory	Theory of membrane potential	3	1
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Public Relations	General relation	3	2
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Fluid Contact Potential	Liquid – junction potential	3	3
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Classification	Classification	3	4
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Glass electrode potential	Origin of the glass electrode potential	3	5
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Solid phases - ion selective electrodes	Solid state ion-selective electrodes	3	6
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Measurement of concentrations of ionic complexes	Concentration measurement of uncomplexed ions	3	7
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Measurement of total concentrations	Measurement of total concentration	3	8
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Design of Ion Selective Electrodes Cells	Cell design of ion-selective electrodes	3	9
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Characteristics of Ion Selective Electrodes	Characterization of ion-selective electrodes	3	10
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Methods of Analysis	Method of analysis	3	11
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Direct Potentiometric Method Standard Addition Method	Direct potentiometric method Standard addition method1- Paper lectures 2- Electronic screen	**3**	**12**
Weekly exams and reports	1- Paper lectures	Multiple standard addition	Multiple standard addition	**3**	**13**

	2- Electronic screen	Potentiometric titration	Potentiometric titration		
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Gaussian Distribution General application of ion selective electrodes	Gaussian Distribution General application of ion selective electrodes	**3**	14
Weekly exams and reports	1- Paper lectures 2- Electronic screen	statistical	statistical	**3**	15

	1. Infrastructure
1-Selective ion sensitive electrodes / G.J. Moody and J.D.R. Thomas. Moody, G. J. Thomas, John David Ronald. Watford, England : Merrow Publishing, 1971. 2-Ion selective electrodes JIRI KORYTA	1- Required textbooks
	2- Main references (sources)
	a) Recommended books and references (scientific journals, reports, ...)
	b) Electronic references, websites, ...

1. Curriculum development plan
Keeping pace with the development in the preparation and methods of assigning materials in general using the selective poles method

Master / Second Course
Specialization: Analytical Chemistry
Advanced Methods of Elemental Analysis

Course Description

Study the mechanisms and devices for qualitative and quantitative analysis and how to deal with them and identify the types of techniques for separating and detecting various organic and inorganic compounds.

University of Baghdad / College of Science	1. Educational Institution
Chemistry Department	2. University Department/Center
Advanced Methods of Elemental Analysis	3. Course Name/Code
Weekly	4. Available Attendance Forms
Second Semester / 2023-2022	5. Semester/Year
3 Hours	6. Number of Study Hours (Weekly)
1\9\2022	7. Date this Description was Prepared

. Course Objectives

The objective of teaching the Advanced Instrumental Analysis course / second semester is to identify the mechanisms and devices for qualitative and quantitative analysis and how to deal with them and to identify the types of techniques for separating and detecting various organic and inorganic compounds. The course also includes a full detailed presentation of these techniques in terms of the mechanism of work, parts of the devices and types of materials specialized in detecting them.

2. Learning outcomes and teaching, learning and evaluation methods

A- Cognitive objectives

A1- Identify the various instrumental devices used in quantitative and descriptive analysis.

A2- Identify advanced instrumental analysis.

A3- Identify new separation and extraction methods.

A4- Identify methods for estimating elements by absorption and atomic emission

B- Course skill objectives

B1- Teaching the student how to use instrumental devices to examine and detect concentrations and types of materials and compounds.

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 in solving some mathematical and statistical problems.

B3- Teaching the student to benefit from the Internet to extract research and summary reports on the prescribed practical material

10- Teaching and learning methods

Clarifying the scientific material through approved analytical books and creating paper and electronic lectures to clarify the mechanisms used under study.

Suggested discussion within the lecture.

Continuous use of the World Wide Web (Internet).

Creating an electronic class and a channel on the Telegram website.

11- Evaluation methods

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

Conducting monthly exams and evaluating external reports and research required from the student.
Conducting electronic news.
C- Emotional and value goals
C1-The ability to infer and suggest external questions and issues that expand the student's thinking.
D- General and transferable qualification 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 among them.
D2- Developing personal skills through scientific trips to sites specialized in chemical transactions.

Course structure .1

Evaluation method	Teaching method	Name of unit/course or topic	Required learning outcomes	hours	Week
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Spectral Methods (A) 1. Atomic absorption spectrometry 2. Atomic fluorescence spectrometry Atomic emission spectroscopy 3. UV-Visible spectrophotometry 4. Infrared Spectroscopy 5. Nuclear Magnetic Resonance Spectroscopy 6. Electron Spin Resonance Spectroscopy 7. Turbidimetry, Chemiluminescence and electrochem-iluminescence. Electrochemical Methods: (B) 1. Potentiometry 2. Amperometry 3. Conductometry 4. Voltammetry Separation Methods (C) 1. Chromatography 2. Electrophoresis Mass spectrometry 1-Atomic Emission Spectrometry 2-Atomic Absorption Spectrometry 3-Atomic Fluorescence Spectrometry	Introduction and Classification of Instrumental Analysis	**3**	**1**
Weekly exams and reports	1- Paper lectures 2- Electronic screen	- Instrumentation - LIGHT SOURCES - The Hollow Cathode Lamp (HCL): - Electrodeless Discharge Lamp (EDL): - The advantages of EDL compared with HCL are: - *EDL versus HCL*	Atomic Spectrometry	**3**	**2**
Weekly exams and reports	1- Paper lectures 2- Electronic screen	- Atomizer (Sample Cell) *Burner Heads* Nebulizers Flame Tyeps	Atomic Spectrometry	**3**	**3**

		Atomization process in a flame for Magnesium sulfate. Flame Atomization *Analytical Interferences in Flame AAS* Matrix interferences: To overcome matrix interferences, Standard additions method: Chemical interferences: *Chemical interferences can normally be overcome in two ways:* There are <u>two means</u> of dealing with this problem to eliminate the interference.			
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Ionization Interference: Spectral interferences: Background Absorption: two line method .1 2- Continuum Source .2 Background Correction QUANTITATIVE ANALYSIS BY ATOMIC ABSORPTION Characteristic Concentration vs. Detection Limit Characteristic Concentration Detection Limit (D.L): *The standard procedure for establishing D.L's by FAAS* *High Sensitivity Sampling Systems for FAAS* FAAS COLD VAPOR MERCURY TECHNIQUE Advantages of the Cold Vapor Technique Limitations to the Cold Vapor Technique HYDRIDE GENERATION TECHNIQUE Advantages: Disadvantages: Principle Instrumentation - LIGHT SOURCES	Atomic Spectrometry	**3**	**4-5**

Weekly exams and reports	1- Paper lectures 2- Electronic screen	ETA-AAS Instrumentations Graphite furnace system components The Graphite Furnace Atomizer The Graphite Furnace Power Supply and Programmer Temperatures Programming In ETA 1- Drying Step 2-Ashing (pyrolysis) Step 3-Atomization Step Interferences in Electrothermal AAS A-Spectral interferences Emission Interference: -1 To eliminate this interference problem – Molecular Absorption -2 (Background absorption) Methods for Background Absorption Correction 1- Nearby line (Two line method): 2-Continuum Source Method Zeeman Background Correction Method -3 Types of indirect reactions to relay on by AAS Precipitation reactions: -1 Reaction of the analyte with a metal chelate -2 Formation of heteropoly acids -3 Solubilization or volatilization of metal ions from pure metals. -4 Reduction to the element, -5 The selective extraction or precipitation of one oxidation -6 Displacement of some metal ions from their complexes. -7 *applications*	Electrothermal Atomic Absorption Spectrometry	**3**	**6-7**

Weekly exams and reports		The First Exam	The First Exam	**3**	**8**
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Determination of drugs and pharmaceutical preparations: The pharmaceutical compounds or preparation can be classified into: -1 Antibacterial and Antifungal Drugs such as -2 Sedative and Hypotic Drugs: such as the compounds of Barbiturates and Benzodiazepines -3 Hormones: such as Ethinyloestradiol and Insulin -4 Vitamins: B1, B12, vitamin C, Folic acid -5 Other Drugs such as: - Methylampphetamine and Ephedrine - Strychnine and Brucine - Noscapine and Chlorprothixene - Chloropheniramine meleate (MCP) - Metoclopramide -Theobromine Chloramphenicol Penicillin Benzodiazepines Hormones (Insulin) Vitamins (Vitamin C) Metals in pharmaceutical Preparations Oxygen compounds 1- Indirect Electrothermal Atomization Atomic Absorption Spectrometric Determination of the Drug Desferrioxamine in Some Pharmaceutical	Indirect Analysis by Atomic absorption Spectrometry	**3**	**9-10**

		Preparations Using Vanadium (V) as a Mediating Element Determination of Desferrioxamine in the Drug Desferal™ as DFOM-Au (III) Complex by Using Indirect Electrothermal Atomic Absorption Spectrometry and Other Techniques. An Indirect Atomic Absorption Spectrophotometric Determination of Trifluoperazine Hydrochloride in Pharmaceuticals			
Weekly exams and reports	1- Paper lectures 2- Electronic screen	What are the Analytical Techniques based on Atomic Spectrometry? What are the Atomization /Excitation Sources? Why ICP-OES? Major limitations of AAS Electrical discharges: ICP-OES INSTRUMENTATION Steps of ICP-AES analysis ICP-OES Instrument composed of: PRODUCTION OF EMISSION Torches Cross section of an ICP torch and load coil depicting an ignition sequence. Region of Plasma: Temperature: Why we choose the Argon as a Plasma gas? Applications of ICP-OES *Agricultural and Foods:* *Biological and Clinical* *Organics* *Environmental and Waters* *Geological*	Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES)	**3**	**11**
Weekly exams and reports	1- Paper lectures 2- Electronic screen	What is ICP-MS? How does an ICP-MS work? What is ICP-MS used for? How do I do ICP-MS analysis**?**	Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)	**3**	**12**

Weekly exams and reports	1- Paper lectures 2- Electronic screen	Principle Instrumentations Application in determination of elements	Flow injection analysis	**3**	**13**
Weekly exams and reports	1- Paper lectures 2- Electronic screen	Principle Instrumentations Application in determination of elements	Polarography	**3**	**14**
		The Second Exam	**The Second Exam**	**3**	**15**

11- Infrastructure	
Fundamentals of analytical chemistry /Skoog and West ,7th ed.,2000 Fundamental of analytical chemistry by Skoog, West, Holler & Crouch, 8th , 2004	Required textbooks
Introduction to Instrumental Analysis by Robert D. Braun	Main references (sources)
	Recommended books and references (scientific journals, reports, etc.)
	Electronic references, websites, etc.

12- Curriculum development plan
Includes adding the latest automated methods for estimating elements and organic compounds.

Master's / Second Course
Specialization: Analytical Chemistry
(Amplification 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.

Ministry of Higher Education and Scientific Research - University of Baghdad	1. Educational institution
University of Baghdad Scientific	2. Academic department/center
Analytical Chemistry / Amplification reaction(Amplification reactions)	3. Course name/code
Weekly (student class for master's students, specialization and non-specialization)	4. Available forms of attendance
Second course - 2023-2022	5. Semester/year
45 and weekly 3 hours for master's students	6. Number of study hours (total)
1\9\2022	7. Date this description was prepared

5- 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 selected chemical reactions that are more selective and sensitive in the direction of low detection limits and wide ranges of the calibration curve without suffering from the effects of foreign substances and in a very small size to be used in all industrial, environmental, health and scientific research fields.

6. Course outcomes and teaching, learning and evaluation methods

A- Knowledge and understanding or customary objectives:

A1- Obtaining a master's degree in chemistry

Identifying the various chemical reactions of substances present in small concentrations and identifying the necessary techniques for their analysis to diagnose many organic and inorganic compounds, drugs and ions

A2- Applying these reactions using various techniques through working in the field of health and pathological and industrial analyses.

A3- Application of this technology 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 the devices or practical problems of 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 to diagnose them.

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 .5

Evaluation method	Teaching method: In-person	Unit Name / or Topic (Second Course) Master	Required learning outcomes	hours	week
Short and semester exams and daily assignments	Lectures using the whiteboard	Direct amplification reaction - Indirect amplification reaction	Principle of direct and indirect amplification reactions	3	1
	Lectures using the whiteboard	- Amplification of anions - Iodide , Bromide , - Chloride	Amplification of negative ions	3	2
	Lectures using the whiteboard	Amplification of Sulpher ions : - Sulfide ion . sulphate ion , Sulphite ion , Thiosulphate ion	Amplification and estimation of sulfur compounds	3	3
	Lectures using the whiteboard	Amplification and separation of pairs of species -	Amplification and analysis methods for a mixture of compounds	3	4
Short and semester exams and daily assignments	Lectures using the whiteboard	- Thiocyanate ion - Amplification of inorganic nitrogen compounds - Amplification of cations -	Various compounds	3	5
	Lectures using the whiteboard	Arsenic ion , copper ion , - mercury ion , silver ion , bismuth ion , Mn(II) , Mg (II) , Tl (I) , Pb (II) . Amplification of hydrogen - peroxide	Analysis and amplification of elements	3	6
	Lectures using the whiteboard	Amplification of - hydrazine Amplification of Aldehyde - compounds Amplification of amino - alcohol	Analysis and amplification of organic compounds	3	7

	Lectures using the whiteboard	- Amplification of poly nuclear aromatic compounds - Oxidation & coupling reaction for determination of different organic compounds (Application) .	Application for various compounds	3	8
	Lectures using the whiteboard	- Azo salt formation & coupling reaction & Application	Nitrogenation and coupling reactions	3	9
Short and semester exams and daily assignments	Lectures using the whiteboard	- Precipitation from homogeneous solution & Application	Precipitation from homogeneous solutions	3	10
	Lectures using the whiteboard	Application in drug estimation and spectroscopic or electrical analysis	Spectroscopy and magnification	3	11
Short and semester exams and daily assignments	Lectures using the whiteboard	Analysis and magnification of aromatic and heterocyclic organic compounds	Analysis of aromatic compounds	3	12 و13
		Monthly exam	Exam	3	14

1. Curriculum development plan:	
Continue to develop the curriculum based on recent editions of books and references.	
1. Infrastructure	
1- Required textbooks	Spectrochemical analysis (Ingle & Crouch) 1988 - Quantitative inorganic analysis (Belcher , Nutten & Macdonald)- - Indicator- Bishop - 1972 In addition to the international network of the Internet
2- Main references (sources)	Douglas A.Skoog , Donald M. West & F.James Holler , Stanley R.Crouch , Foundamentals of Analytical Chemistry , 2004 , eight edition , THOMSON , Australlia.
A) Recommended books and references (scientific journals, reports, ...)	(Software and websites after entering:Different reaction of amplification reaction))

Foundamentals of Analytical chemistry (Amplification reaction) Google chrome	B) Electronic references, websites

Course Description / Scientific 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 2022-2023	5. Semester/year
1 hour = 15 x 30 hours	6. Number of hours of study (total)
2022/9/1	7. The date this description was prepared.

8. Course objectives

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 Structure

Evaluation method	Teaching method	Name of unit/course or topic	Required learning outcomes	hours	Week
Weekly exams	Electronic screen	Research and researcher	The student will be able to know the basics of the scientific research methodology material	1 hour	First
Weekly exams	Electronic screen	Hidden knowledges.facts		1 hour	Second
Weekly exams	Electronic screen	Structure of a scientific paper	The student will be able to know the basics of the scientific research methodology material and how to choose and prepare the research topic	1 hour	Third

Weekly exams	Electronic screen	Title (features of effective title, types of title)	The student will be able to know the structure of the scientific article	1 hour	Fourth
Weekly exams	Electronic screen	Publication process	The student will be able to know how to choose the appropriate title, abstract, introduction and conclusions when writing the research article	1 hour	Fifth
Weekly exams	Electronic screen	Important terminologies: Research originality	The student will be able to know the steps for publishing the research article	1 hour	Sixth
Weekly exams	Electronic screen	Related work, literature review	The student will be able to know some terms related to the basics of writing such as original research and valuable research How to choose the required sources when writing the first chapter and reviewing references	1 hour	Seventh
Monthly exam				1 hour	Eighth
Weekly exams	Electronic screen	Reviewer's suggestion and editor decision	The student will be able to know how to evaluate the 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	Ninth
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	1 hour	Tenth
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	Eleventh
Weekly exams	Electronic screen	Impact Factor and h-index	Explain the meaning of the impact factor and Hirsch coefficient	1 hour	Twelfth
Weekly exams	Electronic screen	Plagiarism	Scientific plagiarism and electronic plagiarism		Thirteenth
Weekly exams	Electronic screen	Organization Ref. using ENDnote software	The student will be able to index and write sources using ENDnote.		Fourteenth
Monthly exam					Fifteenth

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

Master / Second Course
Specialization: Biochemistry
Chemistry of proteins and separations methods

Course Description

Study of the structure and complex composition of proteins and knowledge of the types and groups of the basic large biological molecules (proteins) that exist.

University of Baghdad	1- Educational institution
College of Science-Department of Chemistry	2- Academic department/center
Protein Chemistry and Separation Methods	3- Course name/code
Integrated Online and In-person	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 of preparation of this description

Course objectives

Enabling the student to know proteins and their complex structure in detail and in a manner that is equivalent to the advanced level of knowledge in the world

Enabling the student to know the types and groups of the basic large biomolecules (proteins) that exist

8. Course outcomes and teaching, learning and evaluation methods

A- Cognitive objectives

A1- Enabling the student to know proteins and their complex structure in detail and in a manner that is equivalent to the advanced level of knowledge in the world

A2 Enabling the student to know the types and groups of the basic large biomolecules (proteins) that exist in the body of the living organism

A3- Identify the most important methods of separation of proteins and all biomolecules

B- Course specific skill objectives

B1- Identify the importance of biochemistry for the living organism

B2- Know how biochemistry is related to other sciences

B3- Distinguish some components of the living organism from the large biomolecules practically

Teaching and learning methods

1- Using the display screen

2- E-learning

3- Preparing reports and homework

4- Applying the material Theory in practice in the laboratory

Evaluation methods

Questions + homework and final exam

C- Emotional and value-based objectives

C1- Creating scientific competencies characterized by professionalism, transparency, honesty and integrity.

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.

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

D4- Communicating effectively and the ability to lead work teams.

Course Structure .8

Evaluation method	Teaching method	Unit name/topic	Required learning outcomes	hours	week
Homework + Final Exam	Online video lecture	Amino acids Structure of amino acids Stereochemistry of α-amino acids		**6**	**1-2**
Homework + Final Exam	Online video lecture	Properties of Amino acid side chain Modified Amino acids Peptides and the peptide bond		**6**	**3-4**
Homework + Final Exam	Online video lecture	Structure and stability of the peptide bond		**6**	**5-6**
Homework + Final Exam	Online video lecture	Primary structure of proteins		**6**	**7-8**
Homework + Final Exam	Online video lecture	Higher level of protein organization Secondary structure: Regular way to fold the peptide chain Ramachandran		**6**	**9-10**
Homework + Final Exam	Online video lecture	Fibrous proteins		**6**	**11-12**
Homework + Final Exam	Online video lecture	Globular proteins		**6**	**13-14**
		exam			**15**

Principles of Biochemistry, Lehninger, 5th ed. 2008 -1 Biochemistry By Voet -2	Required Textbooks

Koolman J, K.H. Roehm Color Atlas of Biochemistry , 2 nd edition. Thieme Koolman J, K.H. Roehm. Color Atlas of Biochemistry , 2nd edition. Theme	Main References (Sources)
	Recommended books and references (scientific journals, reports, etc.)
	Electronic references, websites, etc.

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

Master / Second Course
Specialization: Biochemistry
Biochemistry of Blood
Biochemistry of Blood

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
Chemistry Department	2. University department/center
Blood Chemistry / Master	3. Course name/code
Power Point	4. Programs in which it is included
Lists of names for Master's students	5. Available forms of attendance
Second semester /	6. Semester/year
3 hours per week	7. Number of study hours (total)
2022/1/20	8. Date this description was prepared

Course objectives

1- Introducing the student to the components of blood: cells and plasma and how to separate them from each other

2- The normal proportions of each of its components.

3- Diseases that can be diagnosed through laboratory tests.
4- Blood types
7. Learning outcomes and teaching, learning and evaluation methods
A- Knowledge and understanding
A1- The importance of knowing the components of blood
A2- Methods of separating blood components and the differences between them.
A3- Knowing the relationship between the concentration of blood components and disease.
A4- Diagnosing diseases and understanding the cause of infection.
B- Subject-specific skills
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 subject.
B3- Discussing students within the lecture and asking questions to expand the student's understanding.
Teaching and learning methods

Approved books

Paper lectures

Evaluation methods

Short surprise exams

Ongoing monthly exams

Reports and research required from the student

C- Thinking skills

C1- Analysis

C2- Linking information

C3- Memorization

C4- Ability to draw conclusions

Teaching and learning methods

Scientific conclusion and analysis

Evaluation methods

Short exams (oral and written) and semester exams

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

D1- Conducting scientific debates with other universities

D2- Skill of working in government and private health laboratories.

Course structure .6

Evaluation method	Teaching method	Name of unit/course or topic	Required learning outcomes	hours	Week
Exams and Seminars	Theoretical	**Overview of blood**	**The major functions of the blood, the constituents of the blood. The organic and inorganic constituents of the blood plasma. the compositions of blood plasma and blood serum.**	**3**	**1**
Exams and Seminars	Theoretical	**Formed elements**	**production (hematopoiesis),growth factors, types, description, and general function**	**3**	**2**
Exams and Seminars	Theoretical	**Red blood cell**	**structure and functions, regulation of their production (growth factors), metabolism in RBC, reaction of importance in relation to oxidative stress in blood cells. The regulation of RBC breakdown and synthesis.**	**3**	**3**
Exams and Seminars	Theoretical	**Anemia**	**Changes of the subunit composition of hemoglobin tetramers during development (embryonic, fetal and adult subunits). Abnormal hemoglobines. The classification of the causes of anemia. Structure and components of RBC Membrane and related genetic diseases.**	**3**	**4**
Exams and Seminars	Theoretical	**ABO blood group**	**The biochemical bases of the system; types, structure, differences, Rhesus blood group, blood transfusion reaction.**	**3**	**5**

Exams and Seminars	Theoretical	**White Blood Cell**	**classification, differences in structure and function between WBC types, differences between WBC and RBC (structure, function).**	**3**	**6**
Exams and Seminars	Theoretical	**White Blood Cell**	**WBC production and precursors, half-life, the unique enzymes and proteins in neutrophils, formation of microphages and the chemical reactions. The inflammatory response sequence.**	**3**	**7**
Exams and Seminars	Theoretical	**Lymphocytes**	**types, differences, functions, the primary response and antibody formation. Abnormal WBC count: causes for each type and the disease(leukocytosis and leucopenia)**	**3**	**8**
Exams and Seminars	Theoretical	**Blood plasma proteins**	**the compositions of blood plasma, major functions, biosynthesis, chemical structure, characteristics of main blood plasma proteins: albumins, globulins and fibrinogen, polymorphism, half life, acute phase proteins, negative acute phase proteins.**	**3**	**9**
Exams and Seminars	Theoretical	**Major Plasma Proteins-chemistry and clinical significance**	**classification according to separation method, characteristic and differences.**	**3**	**10**
Exams and Seminars	Theoretical	**Major Plasma Proteins-chemistry and clinical significance**	**Details of the most important plasma proteins: Albumin, ceruloplasmin, C reactive protein, haptoglobin and HP- HB complex. Plasma protein related to iron: transport, and storage. Antiproteinases types and function.**	**3**	**11**
Exams and Seminars	Theoretical	**Major Plasma Proteins-chemistry and clinical significance**	**Continue to previous lecture: related diseases according to causes; genetic, or deficiency.**	**3**	**12**
Exams and Seminars	Theoretical	**Immonuglobins**	**production, types, function, structures.**	**3**	**13**

Exams and Seminars	Theoretical	**Hemostasis and thrombosis**	**phases, intrinsic and extrinsic pathways, formation of fibrin (chemical reaction and fibrolysis). Control of circulating thrombin**	**3**	**14**
Exams and Seminars	Theoretical		**Some important aspects in blood genetic diseases**	**3**	**15**

1. Infrastructure	
Scientific books and the latest published research on the subject, in addition to lectures. Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell. **Harper's Illustrated Biochemistry**, 2008, a LANGE medical book, twenty-sixth edition. -1 Jeremy m. Berg, John . Tymoczko, Lubert Stryer. **Biochemistry**, fifth ed. 2009, W.H Free and Company. -2 Gerhard Krauss. **Biochemistry of Signal Transduction and Regulation.** Third edition, WILEY-VCH V GmbH & Co. KGaA, Weinheim 2003. -3	Required readings: Basic texts Course books Other
	Special requirements (including, for example, workshops, periodicals, software, and websites)
	Social services (including, for example, guest lectures, vocational training, and field studies)

1. Admission	
	Prerequisites
5	Minimum number of students
40	Maximum number of students

Master / Second Course
Specialization: Biochemistry
Enzymes and their applications in clinical chemistry

Course Description: Enzymes and Their Applications in Clinical Chemistry

Study of enzyme applications in clinical chemistry and explaining the role of enzymes in biochemical reactions and how to regulate their work, enzyme kinetics and types of inhibition.

University of Baghdad	1. Educational institution
College of Science / Department of Chemistry	2. Academic department/center
Enzymes and their applications in clinical chemistry	3. Course name/code
In-person	4. Available forms of attendance
Second semester / 2023-2022	5. Semester/year
45 theoretical hours	6. Number of study hours (total)
1\9\2022	7. Date this description was prepared

Course objectives

1- Introduction to enzymes with a study of enzyme kinetics as well as types of inhibition
2- Introduction to clinical chemistry and how to deal with medical laboratories.
3- Identify enzyme applications in clinical chemistry and explain the role of enzymes in biochemical reactions and how to regulate their work.
4- Explain how enzymes are used in clinical chemistry, especially in diagnosing diseases such as liver diseases.

1. Course outcomes and teaching, learning and evaluation methods

- Cognitive objectives.

1- Identify enzyme kinetics and types of inhibition.
2- Identify how to regulate enzymatic work.
3- Identify clinical chemistry and how to deal with medical laboratories.
4- Identify how to benefit from enzymes in diagnosing diseases.

B- Program skill objectives:

1- Communicate with students based on the principle of e-learning through the e-class and Telegram.
2- Continuous discussion during the e-lecture with asking questions to encourage student participation and expand their understanding of the scientific material.
3- Teaching students to benefit from scientific references and the Internet.
Teaching and learning methods
Providing students with the basics and topics related to knowledge and systems explained in:
1- Clarifying and explaining the study materials through the whiteboard and using PowerPoint using LCD screens and Data show
2- Providing students with knowledge through homework assignments for the study vocabulary
3- Asking students to visit the library to obtain academic knowledge related to the study vocabulary
4- Improving students' skills by visiting websites to obtain additional knowledge of the study materials
5- Brainstorming during the lecture
Evaluation methods
1. Paper lectures and power point lectures
2. Examples, questions and weekly discussions during the lecture.
3. Basic and modern scientific books. Conducting seminars for students.
4. Daily tests with multiple-choice questions for academic subjects
5. Degrees of participation of difficult competitive questions for students
C- Emotional and value objectives
1. Communicating with students and setting important basics for students in order to deal with the scientific material of the course in a sound manner.
2. Urging students to reach scientific thinking and analysis of scientific information

Teaching and learning methods
Providing students with the basics and additional topics related to previous educational outcomes for skills to solve scientific problems
- Solving a set of practical examples by the academic staff
- Participation of students during the lecture to solve some scientific issues

Evaluation methods
1. Conducting exams through homework to encourage students to read lectures on a daily basis.
2. Conducting short exams during the lecture to encourage students to read lectures on a daily basis.
3. Conducting continuous monthly exams.
4. Reports and research required from the student
D- General and transferable qualification skills (other skills related to employability and personal development).

1- Remind students of the importance of e-learning and guide them to adhere to university laws and regulations.
2- Urge students to gain experience in collecting and analyzing scientific material and using scientific references
- Preparing students to work in government and private pathological analysis laboratories

4- Preparing students to give seminars and teach scientific material

Teaching and learning methods

- Providing students with the basics and additional topics related to the outputs of thinking and chemical analysis
- Forming discussion groups during lectures to discuss chemical topics that require thinking and analysis
- Asking students a set of thinking questions during lectures such as what, how, when and why for specific topics
- Giving students homework that requires self-explanations in causal ways

Evaluation methods

- Daily exams with self-solved homework questions
- Participation grades for competitive questions related to the study material
- Specific grades for homework

10. Course Structure Enzymes and Their Applications in Clinical Chemistry / Theoretical

Evaluation method	Teaching method	Unit name/topic	Required learning outcomes	hours	week
Daily, weekly, semester and final exams	1- Paper lectures 2- Electronic screen	Enzymes and their applications in clinical chemistry	Introduction to Enzymes.	3	First
Daily, weekly, semester and final exams	1- Paper lectures 2- Electronic screen	Enzymes and their applications in clinical chemistry	Catalytic Mechanisms of Enzymes.	3	Second
Daily, weekly, semester and final exams	1- Paper lectures 2- Electronic screen	Enzymes and their applications in clinical chemistry	Enzymes kinetics: .1 Rates of enzymatic reactions.	3	Third
Daily, weekly, semester and final exams	1- Paper lectures 2- Electronic screen	Enzymes and their applications in clinical chemistry	Methods for plotting enzyme kinetics Data.	3	Fourth
Daily, weekly, semester and final exams	1- Paper lectures 2- Electronic screen	Enzymes and their applications in clinical chemistry	Inhibition of enzyme activity.	3	Fifth
Daily, weekly, semester and final exams	1- Paper lectures 2- Electronic screen	Enzymes and their applications in clinical chemistry	Regulation of enzyme activity.	3	Sixth
Daily, weekly, semester and final exams	1- Paper lectures 2- Electronic screen	Enzymes and their applications in	Applications of enzymes: An introduction .	3	Seventh

		clinical chemistry	الامتحان الاول		
Daily, weekly, semester and final exams	1- Paper lectures 2- Electronic screen	Enzymes and their applications in clinical chemistry	Alteration of enzymes activity in diseases (plasma-specific and non-plasma specific enzymes).	3	Eighth
Daily, weekly, semester and final exams	1- Paper lectures 2- Electronic screen	Enzymes and their applications in clinical chemistry	Factors affecting the presence and removal of enzymes in plasma.	3	Ninth
Daily, weekly, semester and final exams	1- Paper lectures 2- Electronic screen	Enzymes and their applications in clinical chemistry	Enzymes as markers in the diagnosis of liver diseases.	3	Tenth
Daily, weekly, semester and final exams	1- Paper lectures 2- Electronic screen	Enzymes and their applications in clinical chemistry	Enzymes as markers in the diagnosis of pancreas diseases.	3	Eleventh
Daily, weekly, semester and final exams	1- Paper lectures 2- Electronic screen	Enzymes and their applications in clinical chemistry	Isoenzymes and other cardiac markers in the diagnosis of myocardial infarction.	3	Twelfth
Daily, weekly, semester and final exams	1- Paper lectures 2- Electronic screen	Enzymes and their applications in clinical chemistry	Enzymes as analytical reagents in clinical laboratory; selected parameters for diagnosis of diabetic mellitus and related diseases.	3	Thirteenth
Daily, weekly, semester and final exams	1- Paper lectures 2- Electronic screen	Enzymes and their applications in clinical chemistry	Enzymes as analytical reagents in clinical laboratory; parameters for diagnosis of kidney diseases.	3	Fourteenth
Daily, weekly, semester and final exams	1- Paper lectures 2- Electronic screen	Enzymes and their applications in clinical chemistry	Seminar. Second exam	3	Fifteenth

11. Infrastructure	
1- Required textbooks	- Lieberman M.A. & Peet A. Marks' Basic Medical Biochemistry: A Clinical Approach (5th Edition),2017

-Punekar, N.S.," ENZYMES: Catalysis, Kinetics and Mechanisms" ,2018 -Murray R.K., Granner D.K., Mayes P.A. & Rodwell V.W.: "*Harper's Illustrated Biochemistry*". 29th ed., Mc Graw-Hill Companies, New York. 2012. - Crook M. A. "*Clinical Biochemistry & Metabolic Medicine*". Hodder & Stoughton Ltd. 2012	2- Main references (sources)
-Burtis C.A., & Ashwood E.R., and Bruns D. E. "Tietz Text book of clinical chemistry and molecular diagnosis" ز. 3rd ed., W.B. Saunders Company Philadelphia. 2012 - Rodewell V.W. , Bender D.A., etal "*Harper's Illustrated Biochemistry*". 31st ed., Mc Graw-Hill Companies, New York. 2018.	A- Recommended books and references
Many sites that deal with biochemistry, including medical sites.	B- Electronic references and websites...

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

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 2023-2024	5. Semester/year
1 hour = 15 x 30 hours	6. Number of hours of study (total)

2023/1/1	7. The date this description was prepared.

8. . Course objectives
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 structure

Evaluation method	Teaching method	Name of unit/course or topic	Required learning outcomes	hours	week
Weekly Exams	electronic screen	Research and researcher	The student will be able to know the basics of the scientific research methodology material	1 hour	First
Weekly Exams	electronic screen	Hidden knowledges.facts		1 hour	Second
Weekly Exams	electronic screen	Structure of a scientific paper	The student will be able to know the basics of the scientific research methodology material and how to choose and prepare the research topic	1 hour	Third
Weekly Exams	electronic screen	Title (features of effective title, types of title)	The student will be able to know the structure of the scientific article	1 hour	Fourth
Weekly Exams	electronic screen	Publication process	The student will be able to know how to choose the appropriate title, abstract, introduction and conclusions when writing the research article	1 hour	Fifth
Weekly Exams	electronic screen	Important terminologies: Research originality	The student will be able to know the steps for publishing the research article	1 hour	Sixth
Weekly Exams	electronic screen	Related work, literature review	The student will be able to know some terms related to the basics of writing such as original research and valuable research	1 hour	Seventh
Monthly exam				1 hour	Eighth
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	Ninth
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	1 hour	Tenth
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	Eleventh
Weekly Exams	electronic screen	Impact Factor and h-index	Explain the meaning of the impact factor and Hirsch factor	1 hour	Twelfth

Weekly Exams	electronic screen	Plagiarism	Scientific plagiarism and electronic plagiarism		Thirteenth
Weekly Exams	electronic screen	Organization Ref. using ENDnote software	The student will be able to index and write sources using the ENDnote program		Fourteenth
Monthly exam					Fifteenth

.12 Infrastructure

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