Ministry of Higher Education and Scientific Research
Scientific Supervision and Scientific Evaluation Apparatus
Directorate of Quality Assurance and Academic Accreditation
Accreditation Department

Academic Description of Post graduate studies
Chemistry Department
MSc Organic Chemistry

2025-2026

Introduction:

The educational program is a well-planned set of courses that include procedures and experiences arranged in the form of an academic syllabus. Its main goal is to improve and build graduates' skills so they are ready for the job market. The program is reviewed and evaluated every year through internal or external professionals like the External Examiner Program.

The academic program description is a short summary of the main features of the program and its courses. It shows what skills students are working to develop based on the program's goals. This description is very important because it is the main part of getting the program accredited, and it is written by the teaching staff together under the supervision of scientific committees in the scientific departments.

Academic Program Description Form

University Name: ..... Wasit university

Faculty/Institute: ..... College of Science

Scientific Department: .....Chemistry Department

Academic or Professional Program Name: Post graduate(MSc. Organic)

Final Certificate Name: ..... MSc. of Science in Organic Chemistry

Academic System: .....Courses

Description Preparation Date: 1/9/2025

File Completion Date: 1/9/2025

Signature:

Head of Department Name:
الدكتور
كمال رشيد حسيجان
رئيس قسم الكيمياء

Date: 16-8-2026

Signature:

Scientific Associate Name:
Assist.prof.Dr.Ali Jabbar Fraih
Deputy Dean For Scientific Affairs and Postgraduate studies

Date: 16-8-2026

The file is checked by:

Department of Quality Assurance and University Performance

Director of the Quality Assurance and University Performance Department:

Date: 16-8-2026

Signature: Donia

م.م دنيا فاضل
مسؤول شعبة ضمان الجودة والاداء الجامعي

Assist.Prof
Dr. Faik Jameel Hassan Mayah
Dean

Approval of the Dean

Academic Program Description

First semester

No.	Course name	No. of credits	No. of hours
1	**Advance Organic chemistry1**	**2**	**2**
2	**Advance Organic chemistry2**	**2**	**2**
3	**Advance Analytical chemistry**	**2**	**2**
4	**Advance Inorganic chemistry**	**2**	**2**
5	**Advance Biochemistry**	**2**	**2**
6	**English Language**	**2**	**2**

Academic Program Description

Second semester

No.	Course name	No. of credits	No. of hours
1	**Physical Organic chemistry**	**2**	**2**
2	**Reactions Mechanism**	**2**	**2**
3	**Heterocyclic compounds**	**2**	**2**
4	**Organic Identification**	**2**	**2**
5	**Polymers**	**2**	**2**
6	**Research Methodology**	**2**	**2**
7	**Seminar**	–	**2**

First Semester

Advance organic chemistry1

Prof. Dr Athraa K. Saker

1. **Program Vision**
Excellence in teaching chemistry, scientific research, and its applications to contribute to community service

2. **Program Mission**
Preparing scientific competencies in chemistry to contribute to scientific, industrial, educational, and economic development in the governorate and solving environmental problems through applied research and providing distinguished educational, research, and training services.

3. **Program Objectives**
• This course offers an in-depth exploration of nucleophilic substitution and elimination reactions in organic chemistry, focusing on their mechanisms, stereochemistry, kinetics, and synthetic implications. Students will examine classical and advanced concepts such as S_N1, S_N2, S_Ni, and neighboring-group participation, as well as elimination mechanisms including E1, E2, and E1cb. Special emphasis is placed on mechanistic reasoning, transition states, intermediate stability, and the influence of molecular structure on reactivity. Additional topics include nucleophilic substitution at vinylic carbons, pyrolytic

eliminations, and the tetrahedral intermediate mechanism relevant to substitution at carbonyl centers.

- Developing scientific research skills and critical thinking in the field of organic chemistry.
- Enhancing the ability to use modern devices and advanced techniques in chemical analysis.
- Qualifying graduates to contribute to the chemical, pharmaceutical, and research industries.
- Prepare graduates specialized in chemistry at a distinguished academic level to supply the labor market in the governorate with the needs of specialists in various fields.
- Participating in finding solutions to local environmental problems and national industries through research and development.
- To be an expert body by providing scientific consultations to the relevant authorities, and organizing scientific seminars and advanced research sessions in various fields of chemistry.
- Supporting twinning between the Department of Chemistry at the university and the departments of chemistry in local and international universities to keep pace with scientific progress and development, and participating in scientific research due to its importance in raising the global rankings of our university.
- Meeting the needs of the department for faculty members by appointing distinguished ones as teaching assistants.
- Conducting various scientific research and linking the department to the community and the surrounding environment.

4. Program Accreditation

The program is subject to the standards of national and international academic accreditation bodies, such as the Commission for Institutional Accreditation, to ensure quality and achieve standards of excellence in higher education. Master of Science in Organic Chemistry.

5. Other external influences

• Labor market requirements: The growing need for specialists in the pharmaceutical, petroleum, and environmental industries.

• Scientific and technological developments: The continuing impact of advances in chemical analysis and organic synthesis techniques.

• Academic and industrial partnerships: Collaboration with universities and research centers to enhance training and employment opportunities.

• Environmental and health legislation: Commitment to environmental standards and chemical safety in industrial and research applications.

* This can include notes on whether the course is basic or optional.

6. Program Description

Year/Level	Course Code	Course Name	Credit Hours	
Master students	**Advan. Organ. Chem.1**	**Advanced Organic Chemistry 1**		**Theoretical 2 hours**

7. Expected learning outcomes of the program

Knowledge

Learning Outcomes 1	1- Demonstrate advanced knowledge and understanding of the fundamental concepts, theories, and principles of organic chemistry. 2- Explain advanced organic reactions, reaction mechanisms, and modern synthetic methodologies. 3- Demonstrate knowledge of advanced spectroscopic and analytical techniques used for the identification and characterization of organic compounds. 4- Understand contemporary developments and emerging areas in organic chemistry and related chemical sciences. 5- Recognize the applications of organic chemistry in pharmaceutical, industrial, environmental, and materials chemistry. 6- Demonstrate knowledge of chemical safety principles, laboratory practices, and appropriate chemical waste management.
Skills	
Learning Outcomes 2	1- Apply advanced organic chemistry concepts to analyze and solve complex chemical problems. 2- Design appropriate synthetic routes for the preparation of organic compounds and select suitable reagents and reaction conditions. 3- Conduct organic chemistry experiments using appropriate laboratory techniques and procedures. 4- Operate, interpret, and critically evaluate data obtained from analytical techniques such as FT-IR, ^{1}H-NMR, ^{13}C-NMR, mass spectrometry, UV-Vis spectroscopy, and elemental analysis.

	5- Analyze experimental results and draw scientifically valid conclusions based on reliable evidence. 6- Search, review, and critically evaluate scientific literature to identify research gaps and current developments. 7- Design and conduct independent scientific research using appropriate methodologies. 8- Use appropriate computational and scientific tools for chemical research, data analysis, and interpretation. 9- Demonstrate critical thinking, scientific reasoning, and effective problem-solving abilities.
Learning Outcomes 3	1- Communicate scientific information effectively through research papers, reports, seminars, presentations, and academic discussions. 2- Work effectively both independently and collaboratively in academic and research environments.
Ethics	
Learning Outcomes 4	1- Demonstrate research integrity and scientific honesty in conducting and reporting scientific investigations. 2- Apply ethical principles in the collection, analysis, interpretation, and presentation of research data. 3- Properly acknowledge and cite scientific sources and avoid plagiarism, fabrication, and falsification of data. 4- Demonstrate responsibility in the safe handling, storage, use, and disposal of chemicals and laboratory materials. 5- Respect professional standards and responsibilities in academic, research, and industrial environments. 6- Demonstrate awareness of the environmental and societal impacts of chemical research and practice. 7- Maintain professional conduct, respect intellectual property, and promote responsible scientific practice.

	8- Demonstrate a commitment to continuous professional development and lifelong learning in organic chemistry and related fields.

8. Teaching and Learning Strategies

The Master's Program in Organic Chemistry adopts a variety of teaching and learning strategies designed to develop advanced knowledge, practical skills, critical thinking, research competence, and ethical professional practice. The main strategies include:

1- **Interactive Lectures:** Presenting advanced concepts, theories, reaction mechanisms, synthetic methodologies, and recent developments in organic chemistry through interactive lectures and academic discussions.
2- **Problem-Based Learning:** Providing students with complex organic chemistry problems that require analysis, interpretation, logical reasoning, and application of theoretical knowledge.
3- **Research-Based Learning:** Involving students in independent research activities, including literature review, identification of research gaps, experimental planning, data collection, analysis, and interpretation.
4- **Laboratory-Based Learning:** Developing practical skills through laboratory experiments involving organic synthesis, purification, characterization, and safe handling of chemicals and laboratory equipment.
5- **Instrumental and Analytical Learning:** Training students to understand and interpret data obtained from advanced analytical techniques such as FT-IR, ^{1}H-NMR, ^{13}C-NMR, mass spectrometry, UV–Vis spectroscopy, and elemental analysis.
6- **Self-Directed Learning:** Encouraging students to independently search for, evaluate, and study scientific literature using scientific databases, textbooks, review articles, and other reliable academic resources.
7- **Technology-Enhanced Learning:** Using digital platforms, scientific databases, molecular modeling and computational tools, electronic resources, and appropriate educational technologies to support learning and research.
8- **Continuous Feedback and Reflective Learning:** Providing regular academic feedback on students' performance and encouraging self-assessment and reflection to improve their knowledge, skills, and research competencies.

9. Evaluation methods

1-Short exams 2- Homework assignments 3- Semester and final exams for theoretical and practical subjects 4- Small projects within the lesson 5- Presentation of activities 6- Semester and final exams and activities

10. Faculty

Faculty Members

Academic Rank	Specialization		Special Requirements/Skills (if applicable)		The number of teaching staff	
	General Organic Chemistry	Special	Advanced organic synthesis, reaction mechanisms, spectroscopy, research supervision		Staff	Lecturer
Associate Professor		Organic chemistry	Ph.D. in Chemistry / Organic Chemistry		1	

Professional Development

Mentoring new faculty members

Professional development of faculty members

Faculty members participate in scientific conferences, workshops, training courses, seminars, research activities, and professional development programs to improve their teaching, research, laboratory, technological, and academic skills. They are also encouraged to publish research in peer-reviewed journals and engage in national and international scientific collaboration.

11. Acceptance Criterion

For the Master's Program in Organic Chemistry, you can use the following formal wording:

Admission to the Master's Program in Organic Chemistry is based on the admission requirements and regulations established by the Ministry of Higher Education and Scientific Research and the University of Wasit. Applicants must hold a relevant Bachelor's degree in Chemistry or an equivalent qualification from a recognized institution. Admission is subject to the applicable competitive selection procedures, available study places, and the required admission criteria for postgraduate studies. Candidates are selected according to their academic qualifications and performance in accordance with the approved postgraduate admission regulations.

12. The most important sources of information about the program

One of the most important sources of information for the study program is based on the recognized curricula and curricula in colleges and scientific departments in European and American universities, in addition to communicating with institutions and state departments that have chemical cadres to develop study programs in order to graduate students with experience to work in these relevant departments and institutions.

13. Program Development Plan

1- Curriculum Development: Review and update course contents to reflect recent advances in organic chemistry, modern synthetic methods, and emerging research areas.
2- Program Learning Outcomes: Review and update learning outcomes to ensure alignment with the knowledge, skills, and ethical competencies expected of Master's graduates.
3- Teaching and Learning: Introduce active learning, problem-based learning, research-based learning, seminars, and technology-enhanced teaching methods.
4- Assessment Methods: Develop diverse and reliable assessment methods that measure knowledge, , research ability, and professional ethics.
5- Research Development: Encourage postgraduate students and faculty members to conduct innovative research and publish results in peer-reviewed and internationally indexed journals.
6- Laboratory Development: Improve laboratory facilities and provide access to modern instruments and analytical techniques relevant to organic chemistry research.

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Master students	Advan. Organ. Chem. 1	Advanced Organic Chemistry 1	Basic	✚	✚	✚	✚	✚	✚	✚		✚	✚	✚	

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

1. Course Name: Advanced Organic Chemistry 1
2. Course Code: Advan. Organ. Chem. 1
3. Semester / Year: first semester
4. Description Preparation Date: 1/9/2025
5. Available Attendance Forms: 1/9/2025
6. Number of Credit Hours (Total) 30 / Number of Units (Total) 30
7. Course administrator's name (mention all, if more than one name)
Email kaljorani@uowasit.edu.iq Kamal Rashid Al Jorani
8. Course Objectives

Course Objectives	This course offers an in-depth exploration of nucleophilic substitution and elimination reactions in organic chemistry, focusing on their mechanisms, stereochemistry, kinetics, and synthetic implications. Students will examine classical and advanced concepts such as S_N1, S_N2, S_Ni, and neighboring-group participation, as well as elimination mechanisms including E1, E2, and E1cb. Special emphasis is placed on mechanistic reasoning, transition states, intermediate stability, and the influence of molecular structure on reactivity. Additional topics include nucleophilic substitution at vinylic carbons, pyrolytic eliminations, and the tetrahedral intermediate mechanism relevant to substitution at carbonyl centers.

9. Teaching and Learning Strategies	
Strategy	1- **Interactive Lectures:** Presenting advanced concepts, theories, reaction mechanisms, synthetic methodologies, and recent developments in organic chemistry through interactive lectures and academic discussions.

	2- **Problem-Based Learning:** Providing students with complex organic chemistry problems that require analysis, interpretation, logical reasoning, and application of theoretical knowledge. 3- **Research-Based Learning:** Involving students in independent research activities, including literature review, identification of research gaps, experimental planning, data collection, analysis, and interpretation. 4- **Laboratory-Based Learning:** Developing practical skills through laboratory experiments involving organic synthesis, purification, characterization, and safe handling of chemicals and laboratory equipment. 5- **Instrumental and Analytical Learning:** Training students to understand and interpret data obtained from advanced analytical techniques such as FT-IR, ^{1}H-NMR, ^{13}C-NMR, mass spectrometry, UV–Vis spectroscopy, and elemental analysis. 6- **Self-Directed Learning:** Encouraging students to independently search for, evaluate, and study scientific literature using scientific databases, textbooks, review articles, and other reliable academic resources. 7- **Technology-Enhanced Learning:** Using digital platforms, scientific databases, molecular modeling and computational tools, electronic resources, and appropriate educational technologies to support learning and research. 8- **Continuous Feedback and Reflective Learning:** Providing regular academic feedback on students' performance and encouraging self-assessment and reflection to improve their knowledge, skills, and research competencies.

10. Course Structure (first semester or second semester)

Week	Hour	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method

1 st	2	Advanced Organic Chemistry 1	Nucleophilic aliphatic substitution S_N2, S_N1	Blended learning	Daily exam and discussion
2 nd	2	Advanced Organic Chemistry 1	Common ion effect, Salt effect, and ion pairs in the S_N1 mechanism.	Blended learning	Daily exam and discussion
3 rd	2		Special Salt Effect and Solvent Effects.	Blended learning	Daily exam and discussion
4 th	2	Advanced Organic Chemistry 1	Neighboring-Group Participation.	Blended learning	Daily exam and discussion
5 th	2		NGP by an alkene and NGP by an aromatic ring.	Blended learning	Daily exam and discussion
6 th	2	Advanced Organic Chemistry 1	S_Ni and S_Ni' mechanism.	Blended learning	Daily exam and discussion
7 th	2		S_N1' and S_N2' mechanism.	Blended learning	Daily exam and discussion
8 th	2	Advanced Organic Chemistry 1	The tetrahedral mechanism.	Blended learning	Daily exam and discussion
9 th	2	Advanced Organic Chemistry 1	Nucleophilic substitution at vinylic carbon.	Blended learning	Daily exam and discussion
10 th	2		Reactivity: The effect of substrate structure, attacking nucleophile, and the leaving group.	Blended learning	Daily exam and discussion
11 th	2	Advanced Organic Chemistry 1	Reactivity: The effect of the reaction medium. Phase-Transfer Catalysis.	Blended learning	Daily exam and discussion
12 th	2		Elimination: Mechanisms and Orientation.	Blended learning	Daily exam and discussion
13 th	2	Advanced Organic Chemistry 1	Elimination (E1 , E2 , E1cB)	Blended learning	Daily exam and discussion

14 th **15th**	2	Advanced Organic Chemistry 1	Pyrolytic elimination. Exam	Blended learning	Daily exam and discussion Month exam

11. Course Evaluation

- Exam %20
- Assignments (Reports /Quizzes/ Programming Project ….) %10
- Final Examination %70

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1. M. B. Smith and J. **March**, (March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure), 6th Edition. 2. Francis A. **Carey** and Richard J. Sundberg, (Advanced Organic Chemistry, **Part A**: Structure and Mechanisms), 5th Edition.

	3. Francis A. **Carey** and Richard J. Sundberg, (Advanced Organic Chemistry, **Part B**: Reactions and Synthesis), 5th Edition. Jonathan **Clayden**, Nick Greeves, and Stuart Warren, (Organic Chemistry), Second Edition.
Main references (sources)	Robert T. **Morrison** and Robert N. **Boyd**, (Organic Chemistry), 7th Edition.
Recommended books and references (scientific journals, reports…)	Robert T. **Morrison** and Robert N. **Boyd**, (Organic Chemistry), 7th Edition.
Electronic References, Websites	https://www.sciencedirect.com/search?qs=imidazoles https://www.ncbi.nlm.nih.gov/nlmcatalog/?term=imidazoles https://pubs.acs.org/action/doSearch?AllField=imidazoles https://link.springer.com/search?new-search=true&query=imidazoles https://www.scopus.com/results/results.uri?st1=imidazoles&st2=&s=TITLE-ABS-KEY%28imidazoles%29&limit=10&origin=searchbasic&sort=plf-f&src=s&sot=b&sdt=b&sessionSearchId=61121f665a19a124180f6d46749114a4 https://www.nature.com/search?q=imidazoles&journal= https://www.science.org/action/doSearch?AllField=imidazoles

First semester
Advance organic chemistry2
Assis.Porf. Dr Kamal Rasheed

14. Program Vision

Leadership and academic and research excellence in the fields of advanced organic chemistry " and its applications, while striving to advance scientific research and innovation to serve the community and meet the requirements of sustainable development and scientific and ".technological progress

15. Program Mission

Preparing scientifically and research-qualified cadres in advanced organic chemistry, and "" equipping them with theoretical and applied skills along with modern laboratory techniques; to conduct innovative scientific research that contributes to addressing environmental and industrial issues, and supporting state institutions and various sectors with specialized expertise ".and sustainable chemical solutions

".

16. Program Objectives

1. **Qualifying Specialized Cadres: Preparing highly competent researchers and specialists in advanced organic chemistry capable of working in academic, research, industrial, and health institutions.**
2. **Advancing Scientific Research: Enhancing students' abilities to design and conduct innovative chemical research using modern laboratory and analytical techniques for synthesizing and characterizing organic compounds.**
3. **Addressing Environmental and Industrial Challenges: Directing graduate research toward solving local environmental and industrial problems and providing sustainable chemical solutions.**

4. **Developing Analytical and Mechanistic Skills: Equipping students with critical thinking capabilities to analyze complex organic reaction mechanisms and propose advanced synthetic pathways.**
5. **Promoting Scientific Ethics: Fostering awareness of laboratory safety, academic integrity, and effective scientific communication through writing and publishing research in reputable journals.**

17. Program Accreditation

The Master of Science program in Organic Chemistry seeks to obtain national program accreditation in accordance with the national accreditation standards established by the Iraqi Ministry of Higher Education and Scientific Research (Directorate of Quality Assurance and .Academic Accreditation), while aligning with international academic standards in the discipline

18. Other external influences

1. **Labor Market and Industrial Demands :**Evolving requirements of the industrial, environmental, health, and energy sectors for highly skilled chemical expertise.
2. **Global Scientific and Technological Advances :**Rapid developments in advanced characterization techniques (such as NMR, Mass, FTIR, XRD) and the applications of green chemistry and nanotechnology.
3. **Ministry Regulations and Directives :**Policy guidelines and academic updating instructions issued by the Ministry of Higher Education and Scientific Research.
4. **International Academic Standards :**Alignment with modern curricula and standards adopted by leading global university graduate programs in organic chemistry.

19. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements	2	4	11.1%	Two courses (English Language & Research Methodology)
College Requirements	**2**	**4**	11.1%	Two shared courses
Department Requirements	**8**	**16**	44.4%	8 specialized courses in Organic Chemistry (distributed over two semesters)
Summer Training	-	-	**1**	**Not required for Master's programs**
Other	**1**	**12**	**33.3%**	Research project and Master's thesis
		36	**100%**	**Total of 12 academic courses (24 credits) +**

				Master's Thesis (12 credits)

* This can include notes whether the course is basic or optional.

20. Program Description

Year/Level	Course Code	Course Name	Credit Hours
Master's	CHEM-	Advanced Organic Chemistry 2	2 hours weekly

21. Expected learning outcomes of the program

1 .Knowledge and Understanding:

- **K1 :**Gain an in-depth and advanced understanding of core concepts and theories in organic chemistry, including organic synthesis and complex reaction mechanisms.
- **K2 :**Understand the principles and applications of advanced characterization techniques (e.g., IR, NMR, Mass, XRD), nanotechnology, and heterocyclic chemistry.

2.Skills:

- **S1 :**Possess the skill to design and synthesize organic molecules and develop modern, sustainable synthetic methodologies (green and nano-chemistry.(
- **S2 :**Master the structural characterization and spectroscopic/thermal analysis of synthesized organic compounds and effectively interpret complex data.
- **S3 :**Utilize specialized chemical software and digital tools for molecular modeling, literature database searches, and technical writing of research papers and theses.

3 .Values, Autonomy, and Responsibility:

- **V1 :**Adhere strictly to laboratory safety protocols and safe handling procedures for hazardous chemicals and instrumentation.
- **V2 :**Demonstrate high standards of academic integrity and research ethics in data collection, reporting, and publication.
- **V3 :**Exhibit the capability to work independently and collaboratively within multidisciplinary research teams to solve chemical, environmental, and industrial problems.

22. Teaching and Learning Strategies

Periodic written and oral examinations conducted throughout the semester to measure theoretical knowledge and comprehension.	**:Midterm Assessment & Interactive Lectures Continuous** .1
Evaluation of hands-on laboratory performance, accuracy in synthetic/characterization procedures, and practical lab reports.	**:Laboratory Assessment & Practical** .2
Assessment of scientific review papers, problem-solving assignments, and critical literature evaluations.	**:Research Reports & Assignments** .3
Evaluation of the student's ability to present scientific topics and defend research findings in public seminars.	**:Presentations & Seminars** .4
Comprehensive end-of-semester written exams assessing course-level intended learning outcomes.	**:Final Examinations** .5
Formal review of the Master's research thesis by expert reviewers and an academic examination committee assessing scientific originality and oral defense.	**:(Defense (Viva Voce & Thesis Evaluation** .6

23. Evaluation methods

1. **Continuous & Midterm Assessment :**Periodic written and oral examinations conducted throughout the semester to measure theoretical knowledge and comprehension.
2. **Practical & Laboratory Assessment :**Evaluation of hands-on laboratory performance, accuracy in synthetic/characterization procedures, and practical lab reports.
3. **Assignments & Research Reports :**Assessment of scientific review papers, problem-solving assignments, and critical literature evaluations.
4. **Seminars & Presentations :**Evaluation of the student's ability to present scientific topics and defend research findings in public seminars.
5. **Final Examinations :**Comprehensive end-of-semester written exams assessing course-level intended learning outcomes.
6. **Thesis Evaluation & Defense (Viva Voce :(**Formal review of the Master's research thesis by expert reviewers and an academic examination committee assessing scientific originality and oral defense.

24. Faculty

Faculty Members

Academic Rank	Specialization	Special Requirements/Skills (if applicable)	The number of teaching staff

	General	Special			Staff	Lecturer
Professor.phd	Chemistry	Organic Chemistry				

Professional Development

Mentoring new faculty members

Conducting a comprehensive orientation program covering academic regulations and research frameworks, alongside training in teaching methodologies and e-learning platforms. New faculty are paired with experienced mentors to ensure quality instruction and graduate supervision.

Professional development of faculty members

-
- Continuous participation in training workshops on modern organic synthesis and advanced spectroscopic characterization (e.g., NMR, FTIR, XRD.(
- Encouraging faculty to publish research in high-impact international journals (indexed in Scopus and Clarivate) and attend national and international conferences.
- Organizing workshops on chemical safety, risk management, and the application of chemical modeling software and data analysis tools.
- Supporting academic sabbaticals and fostering collaborations with international universities and research centers to enhance teaching and research capacities.

25. Acceptance Criterion

The student must be accepted as a graduate of the bachelor of science of chemistry degree, with a minimum average at least 70%.

26. **The most important sources of information about the program**

- **Official Website:** The official website of the College of Science / Wasit University (Department of Chemistry / Postgraduate Studies section).
- **Postgraduate Program Guide:** The academic handbook issued by the college, containing admission requirements, study plans, and detailed course descriptions.
- **Ministry Directives & Regulations:** Regulatory guidelines issued by the Iraqi Ministry of Higher Education and Scientific Research (Research & Development Department and Quality Assurance Directorate).

- **Laboratory Safety Manual:** Institutional rules and safety protocols governing chemical handling and operations in the department's research laboratories.
- **Scientific Databases & Journals:** Scientific digital libraries and databases (e.g., Scopus, ScienceDirect, PubMed) featuring published research and thesis outputs from the department.

27. Program Development Plan

1. **Curriculum Modernization** :Periodically updating course contents to integrate emerging paradigms, such as Green Chemistry, Organic Nanotechnology, and eco-friendly catalytic synthesis.
2. **Infrastructure and Laboratory Upgrading** :Modernizing postgraduate research laboratories with advanced characterization instruments (e.g., FTIR, UV-Vis, TGA/DTA) while enhancing chemical safety protocols in line with international standards.
3. **Promoting High-Impact Publications** :Directing Master's research projects toward publishing results in reputable, peer-reviewed journals indexed in **Scopus** and **Clarivate**.
4. **Digital Integration and Software Training** :Incorporating computational tools (e.g., ChemDraw, Gaussian) and advanced spectral analysis software into the training curriculum.
5. **Fostering Research Collaborations** :Building partnerships with national/international research centers and aligning thesis projects with industrial, environmental, and health sector demands to address practical challenges.

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Master's	CHEM-	Advance Organic **chemistry 2**	Basic	✚	✚			✚	✚	✚		✚	✚	✚	

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

13. Course Name:
Advance organic chemistry
14. Course Code: Quan. Chem.
CHEM−
15. Semester / Year: first semester/
First Semester
16. Description Preparation Date:
14\8\2025
17.Available Attendance Forms:
In-person (Attendance-based)
18.Number of Credit Hours (Total) / Number of Units (Total)
30 hours (Total) / 2 Units
19. Course administrator's name (mention all, if more than one name)
Dr. Athra G Sager

Course Structure (First Semester Schedule)

Week	Hours	Required Learning Outcomes	Unit or Subject Name	Learning Method	Evaluation Method
1st	3	Understand aromaticity criteria and Hückel's rule	Introduction to Aromatic Compounds, Hückel's Rule & Aromaticity Criteria	Lecture & Discussion	Daily Participation
2nd	3	Master electrophilic substitution pathways	Electrophilic Aromatic Substitution Mechanisms (S_EAr) – Part I	Lecture & Problem Solving	Homework
3rd	3	Analyze substituent effects and reactivity	Directive Effects and Substituent Influence in S_Ear Reactions	Interactive Lecture	Pop Quiz
4th	3	Comprehend nucleophilic substitution & benzyne intermediate	Nucleophilic Aromatic Substitution Mechanisms (SNAr & Benzyne Mechanism)	Lecture & Discussion	Participation
5th	3	Apply mechanisms to synthetic strategies	Advanced Mechanistic Insights into Aromatic Systems and Intermediates	Lecture & Case Studies	Short Report

6th	3	Master nomenclature and structure of spiro compounds	Introduction to Spiro Compounds: Nomenclature, Structure, & Classification	Lecture & Presentation	Homework
7th	3	Evaluate steric effects and ring strain	Stereochemistry, Conformational Analysis, and Ring Strain in Spiro Systems	Lecture & Discussion	Pop Quiz
8th	3	Explore spiro synthesis and pharmaceutical roles	Synthetic Methods and Reactions of Spiro Compounds	Presentation Lecture	Assignment Evaluation
9th	3	Assess mid-semester academic progress	**Midterm Examination**	Written Exam	**Monthly Exam Score**
10th	3	Classify fused ring architectures	Introduction to Fused Ring Systems: Structure and Classification	Lecture & Discussion	Participation
11th	3	Study polycyclic aromatic reactions and syntheses	Chemistry of Polycyclic Aromatic Hydrocarbons (Naphthalene, Anthracene, Phenanthrene)	Lecture & Synthesis Design	Homework
12th	3	Understand fused heterocycles chemistry	Fused Heterocyclic Systems: Synthesis and Reactivity	Presentation Lecture	Pop Quiz
13th	3	Analyze relative stability and ring fusion mechanisms	Reaction Mechanisms and Relative Stabilities in Fused Ring Systems	Lecture & Discussion	Participation
14th	3	Enhance research communication and presentation skills	Student Seminars & Presentation of Assigned Topics	Student Presentations	Seminar Evaluation
15th	3	Prepare for comprehensive final examination	Comprehensive Review of Reaction Mechanisms & Final Exam Prep	Open Discussion	Overall Assessment
16-18	-	Evaluate overall course knowledge achievement	**First Semester Final Examinations (21/12/2025 – 08/01/2026)**	Written Final Exam	**Final Grade**

Course Evaluation

Distribution of 100 marks based on student tasks:

- **Midterm Written Examination:** 20 Marks
- **Quizzes & Homework Assignments:** 10 Mark
- **Seminar / Scientific Report & Participation:** 10 Marks
- **Final Written Examination:** 60 Marks
- **Total:** 100 Marks

First semester
Advance Analytical Chemistry
Assis. Prof. Dr. Fatimah Abbas

28. Pr ogram Vision

Excellence in developing advanced academic and research English language proficiency for postgraduate students, establishing a strong linguistic bridge that enables scholars to communicate seamlessly with the global scientific community and contribute to high-impact international literature.

29. Program Mission

To deliver high-quality academic English instruction focusing on critical reading, academic manuscript writing, literature synthesis, and oral research presentation. The course empowers postgraduate researchers to effectively analyze scientific literature, avoid academic misconduct, and disseminate their findings in accredited international journals.

30. Program Objectives

- **Academic Writing Proficiency:** Train students in structuring research papers, drafting abstracts, writing introduction sections, and synthesizing literature reviews using appropriate formal register.

- **Critical Reading & Textual Analysis:** Enable postgraduate students to comprehend complex scientific articles, extract key methodologies and results efficiently, and critically evaluate academic texts.

- **Scientific Presentation Skills:** Equip scholars with the necessary tools to design, deliver, and defend academic presentations (e.g., PowerPoint presentations, conference talks, and viva defenses) in fluent scientific English.

- **Academic Vocabulary & Paraphrasing Mastery:** Expand students' technical and academic vocabulary (Academic Word List) while mastering paraphrasing, summarizing, and proper citation strategies to prevent plagiarism.

- **Ethical & Digital Tool Integration:** Guide students in utilizing modern digital writing tools, reference management software, and artificial intelligence responsibly within ethical academic standards.

31. Program Accreditation
None

32. Other external influences
None

33. Program Structure				
Program Structure	**Number of Courses**	**Credit hours**	**Percentage**	**Reviews***
Institution Requirements	One course	**2**	**20%**	Essential
College Requirements	One course	**2**	**20%**	Essential
Department Requirements	One course	**2**	**20%**	Essential
Summer Training	None	None	None	None
Other				

* This can include notes whether the course is basic or optional.

34. Program Description				
Year/Level	**Course Code**	**Course Name**	**Credit Hours**	
Post-graduate	**Adv Ana chem**	**Advance Analytical chemistry**	**2hours**	**2 credits**

35. Expected learning outcomes of the program
Knowledge
Skills

Ethics

36. Teaching and Learning Strategies

37. Evaluation methods

38. Faculty

Faculty Members

Academic Rank	Specialization		Special Requirements/Skills (if applicable)		The number of teaching staff	
	General	Special			Staff	Lecturer
Assis Prof. Dr Fatimah Abbas	chemistry	Analytical chemistry			staff	

Professional Development

Mentoring new faculty members
Professional development of faculty members

39. Acceptance Criterion

- **Bachelor's Degree Requirement:** The applicant must hold a Bachelor of Science (B.Sc.) degree in Chemistry (or a closely related discipline approved by the department's scientific committee) from a recognized university.

- **Minimum Academic Average:** Achieving the minimum required competitive GPA (typically at least 65%–70% or as specified in the annual ministerial admission guidelines).

- **Competitive Examination:** Obtaining a passing or qualifying score in the official **Postgraduate Competitive Examination** conducted by the Chemistry Department.

- **English Language Proficiency:** Passing the national English Language Proficiency Test mandated by the Ministry of Higher Education and Scientific Research (or providing an equivalent recognized international certificate such as TOEFL or IELTS).

- **Computer & Arabic Proficiency:** Passing the official university proficiency tests in Computer Skills and Arabic Language.

- **Official Clearances & Leave:** Obtaining an official Study Leave approval (for employed applicants), passing the required medical examination, and securing legal/administrative clearances as required by national regulations.

40. The most important sources of information about the program

- **Ministerial Guidelines & Directives:** Official regulations, bylaws, and Quality Assurance standards issued by the Ministry of Higher Education and Scientific Research (MOHESR, Iraq).

- **Approved Departmental Curricula:** The accredited postgraduate study program description and course syllabi approved by the Scientific Committee and College Council.

- **Official Academic Portals:** The official website of the university/college and approved Learning Management Systems (LMS) containing course materials, research guidelines, and administrative updates.

- **Postgraduate Student Handbook:** The official academic handbook issued by the Department of Postgraduate Affairs detailing degree requirements, grading schemes, competitive examination guidelines, and thesis writing regulations.

- **Global Academic Syllabi:** Comparative benchmark curricula from internationally recognized chemistry departments (e.g., American Chemical Society (ACS) and Royal Society of Chemistry (RSC) benchmark standards) used for periodic curriculum modernization.

41. Program Development Plan

- **Curriculum Modernization:** Periodically updating course syllabi and laboratory manuals to integrate emerging analytical and spectroscopic methods, relying on contemporary literature from peer-reviewed journals (e.g., ACS, RSC, Elsevier) and updated benchmark university curricula.

- **Advanced Instrumentation & Practical Integration:** Expanding access to state-of-the-art analytical instrumentation (e.g., modern FTIR, high-field NMR, and TGA/DSC) through collaborative agreements with central university research laboratories and specialized research centers.

- **Digital Tools & Computational Chemistry:** Incorporating software tools (e.g., ChemDraw, MestReNova, and spectral prediction databases) into the curriculum to train postgraduate students in digital spectral interpretation and data processing.

- **Interdisciplinary & Applied Research:** Aligning student research projects with real-world industrial, environmental, and pharmaceutical challenges, promoting collaborative research with external scientific and health institutions.

- **Continuous Evaluation & Quality Enhancement:** Enhancing assessment methodologies through peer review, interactive seminars, and student feedback surveys to continuously refine course delivery and align with quality assurance accreditation standards.

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Post graduate	CHEM 601	Advance analytical chemistry	basic	✚	✚			✚	✚	✚		✚	✚	✚	✚

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

20. Course Name: Advance analytical chemistry
21. Course Code: Advance analytical chemistry
22. Semester / Year: first semester/ 2025-2026
23. Description Preparation Date: 1/9/2025
24.Available Attendance Forms: 1/9/2025
25.Number of Credit Hours (Total) / Number of Units (Total)
26. Course administrator's name (mention all, if more than one name)
27. Course Objectives
Master advanced instrumental analysis techniques, spectroscopic/chromatographic methods, and sample preparation for postgraduate research.
28. Teaching and Learning Strategies
Interactive lectures, practical laboratory sessions, analytical problem-solving, and literature review discussions.
29. Course Structure (first semester or second semester)

Week	Hour	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method

- **Weeks 1–2:** Introduction to Advanced Analytical Spectroscopy, fundamental absorption laws, principles of UV-Visible Spectroscopy (UV-Vis), electronic transitions, and Woodward-Fieser rules calculations.

- **Weeks 3–4:** Fourier-Transform Infrared Spectroscopy (FT-IR), molecular vibration theories, spectral regions, and identification of functional groups.

- **Weeks 5–6:** Factors influencing absorption frequencies in FT-IR (conjugation, hydrogen bonding, ring strain) and practical diagnostic applications for organic and inorganic compounds.

- **Weeks 7–8:** Proton Nuclear Magnetic Resonance Spectroscopy, fundamental principles, chemical shift (δ scale), nuclear shielding, and deshielding effects.

- **Weeks 9–10:** Spin-spin coupling, coupling constants interpretation of complex spectra, and exchangeable protons exchange).

- **Weeks 11–12:** Thermogravimetric Analysis (TGA), principles, instrumentation, decomposition steps, and thermogram curve interpretation.

- **Weeks 13–14:** Differential Thermal Analysis (DTA) & Differential Scanning Calorimetry (DSC), followed by solving Combined Spectral Problems integrating UV-Vis, FT-IR, and Thermal Analysis data.

- **Week 15:** Student Presentations of assigned spectral interpretation reports and Final Evaluation for the first semester.

30. Course Evaluation

- **Class Participation, Attendance, & Quizzes**: 10%
- **Academic Presentation (Oral & Slides)**: 10%
- **Midterm Examination**: 20%
- **Final Written Examination**: 60%
- **Total**: **100%**

31. Learning and Teaching Resources

- **Required Textbooks:**

  - Skoog, D. A., Holler, F. J., & Crouch, S. R. *Principles of Instrumental Analysis*. Cengage Learning.
  - Pavia, D. L., Lampman, G. M., Kriz, G. S., & Vyvyan, J. R. *Introduction to Spectroscopy*. Cengage Learning.

- **Main & Recommended References:**

  - Silverstein, R. M., Webster, F. X., Kiemle, D. J., & Bryce, D. L. *Spectrometric Identification of Organic Compounds*. Wiley.
  - Haines, P. J. *Principles of Thermal Analysis and Calorimetry*. Royal Society of Chemistry.
  - *Analytical Chemistry* (ACS Journal) and *Talanta* (Elsevier) for contemporary research literature.

- **Electronic References & Digital Databases:**

  - **SDBS (Spectral Database for Organic Compounds):** https://sdbs.db.aist.go.jp (Integrated database for FT-IR, NMR, and MS spectra).
  - **WebSpectra (UCLA):** https://www.chem.ucla.edu/~webspectra/ (Interactive problem sets for combined structure elucidation).
  - **NIST Chemistry WebBook:** https://webbook.nist.gov/chemistry/ (Thermochemical and spectroscopic data).

First Semester
Advance Inorganic chemistry
Assis Prof. Dr Atheer AbdAlsaheb

42. **Program Vision**
Achieving academic and research excellence in the field of advanced coordination chemistry, by enabling graduate students to understand the modern principles and theories of coordination chemistry, and linking them to advanced research applications in chemistry and related sciences, thus contributing to the preparation of researchers capable of keeping pace with scientific developments and conducting innovative research of scientific and applied value.

43. **Program Mission**
Advanced Coordination Chemistry aims to provide graduate students with advanced theoretical knowledge and scientific skills related to coordination chemistry, coordination and bonding theories, spatial geometry, and the spectral, magnetic and electronic properties of complexes, while developing their ability to analyze, interpret and link scientific results to the chemical structure of complexes, thereby enhancing their ability to design and study coordination compounds and employ them in modern research and applied fields.

44. **Program Objectives**
The Advanced Coordination Chemistry course aims to: 1- Deepen graduate students' scientific knowledge of modern concepts and theories in coordination chemistry. 2- Explain the nature of the bonding between metal ions and ligands, and understand the factors affecting the formation and stability of coordination complexes.

3- Study modern theories of coordination bonding, particularly valence bond theory, crystal field theory, ligand field theory, and molecular orbital theory.

4- Analyze the geometric and spatial shapes of coordination complexes and understand the factors influencing their geometry.

5- Study the electronic and magnetic properties of complexes and relate them to the electronic configuration of the metal ion and the nature of the ligands.

6- Develop the student's ability to interpret spectra used in characterizing coordination complexes, including infrared (IR) and ultraviolet-visible (UV-Vis) spectra, and other relevant spectroscopic techniques. 7. Understanding the mechanisms of coordination reactions, including substitution, addition, oxidation, and reduction reactions in metal complexes, and studying the kinetic and thermodynamic factors affecting complex formation and stability.

8. Developing skills in analyzing and discussing research results related to coordination complexes and relating spectral, physical, and chemical data to the compound structure.

9. Enhancing the ability to design coordination complexes with the desired properties according to the nature of the metal, the ligand, and the intended application.

10. Connecting coordination chemistry with other scientific disciplines, particularly organic, analytical, and physical chemistry, materials science, nanotechnology, and biochemistry.

11. Identifying modern applications of coordination complexes in catalysis, advanced materials, medicine, biochemistry, and sensing.

45. **Program Accreditation**
Master of Science in Organic Chemistry

46. **Other external influences**

47. **Program Structure**				
Program Structure	**Number of Courses**	**Credit hours**	**Percentage**	**Reviews***
Institution Requirements	One course	**2**		Essential
College Requirements	One course	**2**		Essential
Department Requirements	One course	**2**		Essential
Summer Training	None	None	None	None
Other				

* This can include notes whether the course is basic or optional.

48. Program Description				
Year/Level	**Course Code**	**Course Name**	**Credit Hours**	
2026-2025			**2hours**	**2 credits**

49. Expected learning outcomes of the program
Knowledge

Learning Outcomes 1	1. To understand advanced concepts and theories in coordination chemistry and interpret the fundamental principles governing the formation of metal complexes. 2. To explain the nature of the bonding between metal ions and ligands according to modern coordination theories. 3. To interpret the different spatial geometries of coordination complexes and the factors influencing their determination. 4. To understand the electronic configuration of metal ions and its relationship to the magnetic and electronic properties of complexes. 5. To interpret the spectral properties of coordination complexes and relate them to the electronic and geometric structure of the complex. 6. To understand the fundamental principles of the kinetics and thermodynamics of coordination complex reactions. 7. To understand the mechanisms of substitution, oxidation, and reduction reactions in metal complexes. 8. To learn about the most important methods for preparing and characterizing modern coordination complexes. 9. To understand the relationship between the structure of a complex, its physical and chemical properties, and its various applications. 10- Identifying modern applications of coordination complexes in catalysis, medicine, advanced materials, biochemistry, energy and the environment.
Skills	
Learning Outcomes 2	1. Analyzing the chemical structure of coordination complexes and determining the type of bonding and appropriate spatial geometry. 2. Using modern coordination chemistry theories to explain the behavior and properties of complexes. 3. Interpreting and analyzing data from various spectroscopic sources, especially FT-IR and UV-Vis spectroscopy, and

	utilizing them to determine the nature of the bonding and the structure. 4. Analyzing the magnetic and electronic properties of complexes and relating them to the electronic configuration of the metal ion. Interpreting the results of chemical and physical analyses of complexes in a comprehensive scientific manner. 5. Selecting appropriate techniques for the preparation and characterization of coordination compounds according to the nature of the scientific research. 6. Solving scientific problems related to the preparation of complexes and interpreting their properties and reactions. 7. Utilizing scientific sources and databases to obtain relevant and up-to-date information and research. 8. Designing research proposals in the field of coordination chemistry and linking them to modern applications. Presenting and discussing scientific results using appropriate academic methods. 9- Employing scientific and computational analysis programs and tools when needed in studying complexes and their properties.
Learning Outcomes 3	1-helping the graduated to be able to work in different field confidently.
Ethics	
Learning Outcomes 4	1. Commitment to the ethics of scientific research and academic integrity in conducting research, analyzing results, and publishing findings. 2. Commitment to accuracy and objectivity in recording scientific data and interpreting results. 3. Appreciation of the importance of teamwork and scientific collaboration in conducting advanced research.

	4. Demonstration of scientific responsibility in handling chemicals, equipment, laboratories, and using appropriate methods for waste disposal in accordance with safety requirements. 5. Respect for intellectual property rights and adherence to proper scientific documentation of sources. 6. Development of a positive attitude towards scientific research, lifelong learning, and keeping abreast of the latest developments in coordination chemistry. 7. Employing critical thinking and objectivity when evaluating scientific results and theories. 8. Fostering a spirit of innovation and creativity in designing complexes and exploring new applications for them. 9. Appreciation of the role of coordination chemistry in addressing scientific and applied problems and serving society and the environment.

50. **Teaching and Learning Strategies**
1. Interactive lectures and scientific discussions. 2. Problem-based learning. 3. Inquiry-based learning. 4. Study and analysis of recent scientific research. 5. Presentations and group discussions. 6. Discussion of practical applications and laboratory experiments.

51. Evaluation methods

Periodic and final written examinations.

Quizs.

Evaluation of reports, assignments, presentations, and academic discussions.

Evaluation of class activity and participation.

Practical exercises.

52. Faculty

Faculty Members

Academic Rank	Specialization		Special Requirements/Skills (if applicable)		The number of teaching staff	
	General	Special			Staff	Lecturer
Assistant Professor Dr.	Chemistry	Inorganic Chemistry			Staff	

Professional Development

Mentoring new faculty members

Professional development of faculty members

Developing the skills of faculty members through participation in training courses, workshops and scientific conferences, keeping up with the latest developments in the field of specialization, employing modern teaching and assessment methods, digital technologies and artificial intelligence skills in the educational process, enhancing scientific research skills and publishing in reputable scientific journals, and exchanging experiences and research cooperation in a way that contributes to improving the quality of teaching and scientific research.

53. Acceptance Criterion

• General Ministry Requirement: Applicants must hold a Bachelor's degree from the College of Science (for Master's applicants) or a Master's degree (for PhD applicants) from a recognized university, with a grade point average qualifying them for admission according to the Ministry's admission regulations for the year of application.

• English Language Proficiency Test: Applicants must pass the national English language proficiency test approved by the Ministry of Higher Education and Scientific Research (or submit equivalent international certificates such as TOEFL or IELTS with the required score).

• Competitive Examination: Applicants must pass or achieve a score qualifying them to compete in the competitive examination administered by the Chemistry Department and the College.

• Specialization Matching: The applicant's previous Bachelor's/Master's degree specialization must be within the relevant or required specializations for the program, according to the department's academic equivalency criteria.

• Full-Time Study and Safety: Employees must provide a letter of full-time study leave and pass a medical examination and legal and security clearance tests in accordance with applicable laws and regulations.

54. The most important sources of information about the program

Required books and approved references

Miessler, G. L., Fischer, P. J., & Tarr, D. A., Inorganic Chemistry.
-Housecroft, C. E., & Sharpe, A. G., Inorganic Chemistry.
-Huheey, J. E., Keiter, E. A., & Keiter, R. L., Inorganic Chemistry.
-Principles of Structure and Reactivity.
-Lever, A. B. P., Inorganic Electronic Spectroscopy.
Supporting sources:

؛ Lever, Inorganic Electronic Spectroscopy؛ Crabtree, The Organometallic Chemistry of the Transition Metals؛ Gispert, Coordination Chemistry؛ IUPAC, Nomenclature of Inorganic Chemistry)؛ IUPAC, Gold Book

Electronic references and digital sites:

IUPAC Gold Book؛ IUPAC Red Book؛ NIST Chemistry WebBook؛ Royal Society of Chemistry (RSC)؛ RSC Coordination Chemistry Fundamentals Series

55. Program Development Plan

The program development plan aims to enhance the quality of academic program outcomes and keep pace with scientific and technological advancements in the field of chemistry through:

1- Regularly updating curricula and courses to align with scientific developments and the demands of the job market and scientific research.

2- Developing faculty members' skills through training courses, workshops, conferences, and scientific collaborations.

3- Strengthening the practical and research aspects of the program and providing modern laboratory technologies and equipment to support advanced applications in chemistry.

4- Utilizing e-learning, digital technologies, and artificial intelligence in teaching and scientific research, in accordance with academic standards.

5- Promoting scientific publication and collaborative research, and encouraging applied research and research projects relevant to community needs.

6- Developing assessment methods and adopting diverse approaches to measure the achievement of targeted learning outcomes.

7- Utilizing feedback from students, faculty members, graduates, and stakeholders to continuously improve the program.

8-Conducting periodic reviews of the program, measuring performance indicators and learning outcomes, and implementing necessary corrective actions.

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
		Advanced Inorganic Chemistry	Basic	✚	✚			✚	✚	✚		✚	✚	✚	

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

32. Course Name: Advanced Inorganic Chemistry
33. Course Code: Quan. Chem.
34. Semester / Year: first semester/
35. Description Preparation Date: 2025/9/1
36.Available Attendance Forms:2025/9/1
37.Number of Credit Hours (Total) / Number of Units (Total)
38. Course administrator's name (mention all, if more than one name)
39. Course Objectives

Course Objectives	

40. Teaching and Learning Strategies

Strategy	

41. Course Structure (first semester or second semester)

Week	Hour	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method

42. Course Evaluation
Distributing the score out of 100 according to the tasks assigned to the student, such as daily preparation, daily oral, monthly, written and blended exams, reports …. etc
43. Learning and Teaching Resources

مفردات المنهج ضمن كل اسبوع

الاسبوع الاولThe principle by which the periodic table was built up. Classification of the elements, The representative elements, Main transition elements, Inner transition elements.
الاسبوع الثاني
Introduction of Coordination Chemistry
الأسبوع الثالث
The Valence Shell Electron-Pair Repulsion (VSEPR), hybridization in an inorganic compounds and ions.
الأسبوع الرابع
Electronegativity and Atomic Size Effects
الأسبوع الخامس
Theories and hypotheses in explaining the coordination compound: -
الأسبوع السادس
Nomenclature Rules
الأسبوع السابع
Theory of Bohr’s model of atom
الأسبوع الثامن
The Effective Atomic Number , The carbonyls and The Back-Bonding
الأسبوع التاسع
The Crystal Field Theory C.F.T.
الأسبوع العاشر
The Crystal Field Theory C.F.T.
الأسبوع الحادي عشر
The molecular orbital theory .1
الأسبوع الثاني عشر
Energy level diagram MOT .2
سمنر الأسبوع الثالث عشر
الأسبوع الرابع عشر امتحان

First semester
Advance Biochemistry
Assis.Prof. Dr. Fawzi Hasan Zayer

56. Program Vision

Excellence in teaching biochemistry, scientific research, and its applications to contribute to community health, scientific development, and service.

57. Program Mission

Preparing scientific competencies in biochemistry to contribute to scientific, health, educational and research development through advanced biochemical studies, laboratory applications, and applied research.

58. Program Objectives

1- Develop advanced knowledge of biomolecules, enzymes, metabolic pathways, and biochemical regulation.
2- Develop students' skills in biochemical analysis, laboratory techniques, and interpretation of results.
3- Strengthen scientific research skills and the ability to critically evaluate biochemical literature.
4- Prepare graduates to apply biochemical knowledge in academic, research, laboratory, and health-related fields.
5- Promote professional ethics, scientific responsibility, and safe laboratory practice.

59. Program Accreditation

Master of Science in organic chemistry

60. Other external influences

Current developments in biochemistry, clinical laboratory practice, biomedical research, modern analytical techniques, and the requirements of relevant academic and health institutions.

61. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements	**1**	**30**		
College Requirements	**1**	**30**		
Department Requirements	**1**	**30**		
Summer Training	**0**	**0**		
Other				

* This can include notes whether the course is basic or optional.

62. Program Description

Year/Level	Course Code	Course Name	Credit Hours	
course				

63. Expected learning outcomes of the program

Knowledge	
Learning Outcomes 1	1- Demonstrate advanced knowledge of biomolecules, enzymes, metabolic pathways, and biochemical regulation. 2- Explain the biochemical basis of important physiological and pathological processes.
Skills	
Learning Outcomes 2	1- Apply biochemical methods and laboratory techniques appropriately. 2- Analyze and interpret biochemical data using scientific reasoning. 3- Develop research and problem-solving skills in biochemistry.
Learning Outcomes 3	1- Integrate biochemical knowledge with biomedical and health-related applications. 2- Communicate scientific findings effectively in written and oral forms.
Ethics	
Learning Outcomes 4	1- Demonstrate professional and research ethics. 2- Follow laboratory safety and responsible scientific practice. 3- Recognize the role of biochemistry in serving society and advancing health sciences.

64. Teaching and Learning Strategies

1- Lectures and explanation of advanced biochemical concepts. 2- Scientific presentations using multimedia and data visualization. 3- Self-learning through assignments and guided reading. 4- Discussion of recent scientific literature. 5- Seminars and research activities. 8- Scientific visits when applicable.

65. Evaluation methods

1- Short and periodic examinations. 2- Assignments and scientific reports.. 4- Seminars and presentations. 5- Semester and final examinations for theoretical.

66. Faculty

Faculty Members

Academic Rank	Specialization		Special Requirements/Skills (if applicable)		The number of teaching staff	
	General	Special			Staff	Lecturer
Assis pro Dr.	chemistry	biochemistry	1		1	1

Professional Development

Mentoring new faculty members

Workshops, seminars, conferences, research activities, and specialized training in biochemistry, clinical biochemistry, molecular biology, biochemical analysis, laboratory techniques, and modern instrumentation.
Mentoring New Faculty Members Experienced faculty members provide guidance in teaching, laboratory practice, assessment, research methodology, publication, laboratory safety, and postgraduate supervision.

Professional development of faculty members

Briefly describe the academic and professional development plan and arrangements for faculty such as teaching and learning strategies, assessment of learning outcomes, professional development, etc.

67. Acceptance Criterion

The student must be accepted as a graduate of a relevant bachelor's degree in Chemistry, according to the approved admission regulations.

68. The most important sources of information about the program

The program is informed by recognized curricula in biochemistry and related biomedical sciences at national and international universities, current scientific literature, research laboratories, and relevant academic and health institutions.

69. Program Development Plan

1- Update biochemical course content according to scientific developments and approved procedures.
2- Adopt modern teaching and laboratory methods appropriate to postgraduate learning.
3- Use contemporary assessment methods that measure knowledge, research ability, and scientific communication.
4- Encourage participation in seminars, scientific meetings, and research activities.
5- Strengthen links with biomedical and relevant research institutions.

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Course	1	biochemistry	optional	√	√	√				√	√		√	√	

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

Course Name: Advanced Biochemistry
Advanced Biochemistry
Course Code: Biochemistry
BIOC 501
44. Semester / Year: first semester/
First year semester
45. Description Preparation Date:
2025–2026
46.Available Attendance Forms:
Theoretical lectures, scientific discussions, and seminars
47.Number of Credit Hours (Total) / Number of Units (Total)
30h /2 hours
48. Course administrator's name (mention all, if more than one name)
Biochemistry Faculty Members
49. Course Objectives

The course aims to: 1. Provide students with advanced knowledge of biochemical principles and molecular mechanisms. 2. Explain the structure and functions of major biological molecules. 3. Develop an advanced understanding of enzymes, enzyme kinetics, and regulation. 4. Explain major metabolic pathways and their integration and regulation. 5. Relate biochemical processes to physiological and pathological conditions. 6. Develop students' ability to analyze and interpret biochemical information and scientific data. 7. Introduce students to recent developments and current concepts in biochemistry. 8. Develop scientific thinking and research-oriented skills in postgraduate students.	

50. Teaching and Learning Strategies

Strategy	1. Lectures and scientific explanation. 2. PowerPoint presentations and multimedia. 3. Interactive scientific discussions. 4. Problem-solving and case-based learning. 5. Self-directed learning and guided reading. 6. Discussion of recent scientific publications. 7. Student seminars and presentations. 8. Assignments and scientific reports.

51. Course Structure (first semester or second semester)					
Week	**Hour**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**

1 st	2	Explain the principles and scope of advanced biochemistry	Introduction to Advanced Biochemistry	Lecture & Discussion	Short Quiz
2 nd	2	Describe the structure and biological functions of proteins.	Protein Structure and Function.	Lecture & Discussion	Quiz / Discussion
3 rd	2	Explain enzyme structure, function, and classification.	Enzymes and Enzyme Classification.	Lecture	Short exam.
4 th	2	Analyze enzyme kinetics and factors affecting enzyme activity.	Enzyme Kinetics.	Lecture & Problem Solving.	Assignment.
5 th	2	Explain enzyme regulation and clinical significance.	Enzyme Regulation and Clinical Enzymology.	Lecture & Discussion	Quiz
6 th	2	Describe carbohydrate metabolism and its regulation	Carbohydrate Metabolism	Lecture & Discussion	Short exam
7th	2	Med exam			
8 th	2	Explain lipid metabolism and its regulation.	Lipid Metabolism.	Lecture & Discussion	Assignment
9 th	2	Explain amino acid and protein metabolism.	Amino Acid and Protein Metabolism.	Lecture & Discussion	Quiz
10 th	2	Describe integration and regulation of metabolic pathways.	Integrated Metabolism	Lecture & Problem Solving.	Short exam
11 th	2	Describe biochemical mechanisms of hormonal regulation.	Hormonal Regulation of Metabolism	Lecture & Discussion	Assignment
12 th	2	Explain biochemical mechanisms associated with disease.	Biochemical Basis of Disease	Case-Based Learning.	Quiz
13 th	2	Evaluate recent developments in biochemical research	Current Topics in Biochemistry.	Seminar & Discussion	Assignment
14 th	2	Integrate and apply advanced biochemical concepts	Review and Integration	Discussion & Review	Quiz
15th	2	Final exam			

52. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student, such as daily preparation, daily oral, monthly, written and blended exams, reports .... etc

53. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Lippincott biochemistry
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

First semester
English language
Assis. Prof. Dr. Sarah Badri

70. Program Vision

Excellence in developing advanced academic and research English language proficiency for postgraduate students, establishing a strong linguistic bridge that enables scholars to communicate seamlessly with the global scientific community and contribute to high-impact international literature.

71. Program Mission

To deliver high-quality academic English instruction focusing on critical reading, academic manuscript writing, literature synthesis, and oral research presentation. The course empowers postgraduate researchers to effectively analyze scientific literature, avoid academic misconduct, and disseminate their findings in accredited international journals.

72. Program Objectives

- **Academic Writing Proficiency:** Train students in structuring research papers, drafting abstracts, writing introduction sections, and synthesizing literature reviews using appropriate formal register.

- **Critical Reading & Textual Analysis:** Enable postgraduate students to comprehend complex scientific articles, extract key methodologies and results efficiently, and critically evaluate academic texts.

- **Scientific Presentation Skills:** Equip scholars with the necessary tools to design, deliver, and defend academic presentations (e.g., PowerPoint presentations, conference talks, and viva defenses) in fluent scientific English.

- **Academic Vocabulary & Paraphrasing Mastery:** Expand students' technical and academic vocabulary (Academic Word List) while mastering paraphrasing, summarizing, and proper citation strategies to prevent plagiarism.

- **Ethical & Digital Tool Integration:** Guide students in utilizing modern digital writing tools, reference management software, and artificial intelligence responsibly within ethical academic standards.

73. Program Accreditation

None

74. Other external influences

None

75. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements	One course	**2**		Essential
College Requirements	One course	**2**		Essential
Department Requirements	One course	**2**		Essential
Summer Training	None	None	None	None
Other				

* This can include notes whether the course is basic or optional.

76. Program Description

Year/Level	Course Code	Course Name	Credit Hours	
Post-graduate	**English**	**English**	**2hours**	**2 credits**

77. Expected learning outcomes of the program

Knowledge

- **Knowledge (A):**

  - **A1:** Understanding the rhetorical structure and conventions of academic journal articles, theses, and research proposals.
  - **A2:** Comprehensive knowledge of academic integrity, citation styles (APA, IEEE, Vancouver), and anti-plagiarism guidelines.
  - **A3:** Familiarity with the Academic Word List (AWL) and formal discourse markers required for scholarly communication.

Skills

Skills (B):

- **B1:** Ability to draft clear, concise, and structured research abstracts and introductory sections.
- **B2:** Proficiency in paraphrasing complex scientific ideas and integrating literature seamlessly using proper reporting verbs.
- **B3:** Advanced skill in delivering interactive research presentations and handling academic Q&A sessions confidently.

Ethics

Ethics & Competencies (C):

- **C1:** Commitment to academic honesty, proper attribution of sources, and ethical research reporting.
- **C2:** Cultivation of independent self-learning, critical thinking, and collaborative peer-review skills.

78. Teaching and Learning Strategies

1-Explanation and clarification through lectures 2-How to display scientific materials using data shows and plasma screens 3-Self-learning through homework assignments 4-Continuous daily and weekly surprise tests 5-Guiding students to some sources to benefit from and expand students' understanding of scientific material 6- Graduation projects 7- Scientific visits 8- Seminars and scientific seminars

79. Evaluation methods

1-Short exams 2- Homework assignments 3- Semester and final exams for theoretical and practical subjects 4- Small projects within the lesson 5- Presentation of activities 6- Semester and final exams and activities

80. Faculty

Faculty Members

Academic Rank	Specialization		Special Requirements/Skills (if applicable)		The number of teaching staff	
	General	Special			Staff	Lecturer
Assis. Prof	chem	Physical chem	Phd from UK		staff	

Professional Development

Mentoring new faculty members

Professional development of faculty members

Briefly describe the academic and professional development plan and arrangements for faculty such as teaching and learning strategies, assessment of learning outcomes, professional development, etc.

81. Acceptance Criterion

- **Degree Requirement:** Applicants must hold an accredited Bachelor's degree (for Master's programs) or Master's degree (for PhD programs) from a recognized university, meeting the minimum GPA required by the Ministry's annual postgraduate regulations.

- **English Language Proficiency:** Successful passing of the official **National English Proficiency Test** recognized by the Iraqi Ministry of Higher Education and Scientific Research, or providing an equivalent international certificate (e.g., IELTS / TOEFL) meeting required scores.

- **Competitive Examination:** Achieving a qualifying score in the official **Competitive Examination** conducted by the respective academic department and college.

- **Specialized Alignment:** Compatibility of the applicant's prior academic background with the department's scientific specialization criteria.

- **Legal & Administrative Clearances:** Providing official study leave approval (for employed candidates), medical fitness clearance, and legal/administrative clearance in accordance with national laws.

82. The most important sources of information about the program

- **Advanced Pedagogy Workshops:** Regular participation in training programs focused on modern English for Academic Purposes (EAP) methodologies and blended learning techniques.

- **Digital & AI Integration:** Continuous development in leveraging educational technology, digital editing tools, and ethical AI assistance in language instruction.

- **Research & Publication:** Active involvement in publishing scholarly research in indexed journals (Scopus / Clarivate) within the fields of Applied Linguistics, EAP, and Higher Education.

- **International Collaboration:** Engaging in international webinars, academic exchange, and conferences to align teaching strategies with global higher education standards.

- **Continuous Feedback & Evaluation:** Utilizing student evaluation surveys and external peer-review insights to update and refine course delivery annually.

83. Program Development Plan

- **Curriculum Modernization:** Periodically updating course materials and references using modern EAP textbooks published by internationally renowned university presses (e.g., Cambridge, Oxford, Michigan).

- **Blended Learning & Smart Classroom Integration:** Incorporating smart platforms (e.g., Google Classroom, Moodle) and interactive language software to enhance writing feedback and student interaction.

- **Focus on Publication & Thesis Writing:** Expanding practical writing clinics that guide postgraduate students through drafting actual manuscript sections for Scopus-indexed journals and their final theses.

- **Guest Lectures & Academic Collaboration:** Hosting virtual workshops and guest lectures by international experts in scientific writing and academic publishing.

- **Formative Assessment Refinement:** Implementing continuous peer-review processes, self-assessment rubrics, and portfolio-based evaluations to foster independent learning.

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Post graduate	English	English	basic	✚				✚				✚			

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

54.	Course Name: English
55.	Course Code: English
56.	Semester / Year: first semester/ 2025-2026
57.	Description Preparation Date: 1/9/2025
58.	Available Attendance Forms: in person
59.	Number of Credit Hours (Total) / Number of Units (Total) two
60.	Course administrator's name (mention all, if more than one name)
	Dr Sarah Badri Jasim
61.	Course Objectives
	Develop academic writing, critical reading, and research presentation skills for postgraduate studies.
62.	Teaching and Learning Strategies
	Interactive lectures, practical writing workshops, group discussions, and self-learn assignments.
63.	Course Structure (first semester or second semester)

Week	Hour	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1st	2	A1, A3	Introduction to Academic English (EAP) vs. General English; Structural analysis of	Interactive Lecture & Discussion	Classroom Participation

			research papers.		
2nd	2	B2, A3	Academic Style & Tone: Passive vs. Active voice, hedging, formal register, and clarity in writing.	Practical Exercises	Homework Assignment
3rd	2	B2	Critical Reading Strategies: Skimming, scanning, and fast data extraction from scientific papers.	Group Reading Activity	Short Quiz
4th	2	A3, B2	Building Academic Vocabulary: The Academic Word List (AWL) and technical collocations in research.	Contextual Vocabulary Tasks	In-class Task
5th	2	B2, A2	Techniques of Paraphrasing: Sentence restructuring, synonym	Writing Workshop	Short Written Assignment

			replacement, and idea retention.		
6th	2	B2, A2	Summarizing Techniques: Condensing lengthy articles and identifying core thesis statements.	Individual Task	Practical Exercise Review
7th	2	A2, C1	Academic Integrity & Avoiding Plagiarism: Quotations, citations, and Turnitin similarity reports.	Case Studies & Examples	Quiz on Citation Rules
8th	2	B1	Midterm Assessment & Progress Evaluation.	Written Examination	**Midterm Exam (20%)**
9th	2	B1	Structuring the Introduction Section: CARS model (Creating a Research Space), problem statements,	Analysis of Sample Papers	Introduction Draft Submission

			and research gaps.		
10th	2	B1	Writing the Literature Review: Synthesis of multiple sources, matrix mapping, and thematic organization.	Workshop & Peer Review	Draft Synthesis Assignment
11th	2	B1	Writing Effective Research Abstracts: Types of abstracts, key components, and word limits.	Drafting Exercises	Abstract Submission
12th	2	A3, B2	Transition Words & Cohesion: Discourse markers, cause-and-effect indicators, and logical flow.	Sentence Linking Tasks	Homework Assignment
13th	2	B3	Academic Presentation Skills I: Designing effective scientific	Demonstration & Guidelines	Slide Design Review

			slides, visual aids, and structure.		
14th	2	B3, C2	Academic Presentation Skills II: Body language, voice projection, signposting language, and handling Q&A.	Practical Rehearsals	Peer Assessment
15th	2	B3, C1, C2	Final Course Evaluation & Student Presentations.	Individual Presentations	**Presentatian Evaluation (10%)**

64. Course Evaluation

- **Class Participation, Attendance, & Quizzes**: 10%
- **Academic Presentation (Oral & Slides)**: 10%
- **Midterm Examination**: 20%
- **Final Written Examination**: 60%
- **Total**: **100%**

65. Learning and Teaching Resources

A. Program Level Sources:

1. **Ministerial Guidelines:** Rules and directives issued by the Department of Research & Development and the Directorate of Quality Assurance and Academic Accreditation (MOHESR, Iraq).
2. **Departmental Curricula Guides:** Approved syllabus specifications provided by the Scientific Committee and College Board.
3. **Official University Portals:** Institutional website repository and official Learning Management Systems (LMS).

B. Course Level Sources (EAP / Academic English):

- **1. Required Textbooks:**
  - Swales, J. M., & Feak, C. B. *Academic Writing for Graduate Students: Essential Tasks and Skills*. University of Michigan Press.
  - Hewings, M. *Cambridge Academic English: An Integrated Skills Course for EAP*. Cambridge University Press.
- **2. Main References:**
  - De Chazal, E., & McCarter, S. *Oxford EAP: A Course in English for Academic Purposes*. Oxford University Press.
  - Evans, D., Gruba, P., & Zobel, J. *How to Write a Better Thesis*. Springer.
- **3. Recommended Books & Periodicals:**
  - *Journal of English for Academic Purposes* (Elsevier).
  - Wallwork, A. *English for Writing Research Papers*. Springer.
- **4. Electronic References & Websites:**
  - **Purdue Online Writing Lab (OWL):** https://owl.purdue.edu (Standard reference for writing, mechanics, and citation styles like APA/IEEE).
  - **Google Scholar & ResearchGate:** For literature search and reading authentic journal articles.

Second Semester

Physical Organic chemistry

Assis. Prof Dr. Kamal Rasheed

84. **Program Vision**
Excellence in teaching chemistry, scientific research, and its applications to contribute to community service

85. **Program Mission**
Preparing scientific competencies in chemistry to contribute to scientific, industrial, educational, and economic development in the governorate and solving environmental problems through applied research and providing distinguished educational, research, and training services.

86. **Program Objectives**
The course aims to provide students with an advanced understanding of the relationships between molecular structure and chemical reactivity, including molecular bonding, reactive intermediates, and organic reaction mechanisms; to develop their ability to apply thermodynamic, kinetic, and structural principles to analyze organic reactions; and to familiarize them with modern experimental and computational approaches for investigating reactivity and reaction mechanisms. The course also aims to enable students to appreciate the application of physical organic principles to contemporary areas of chemistry and to critically understand current research in the field.

87. Program Accreditation

The program is subject to the standards of national and international academic accreditation bodies, such as the Commission for Institutional Accreditation, to ensure quality and achieve standards of excellence in higher education. Master of Science in Organic Chemistry.

88. Other external influences

- **Recent developments in physical organic chemistry** and emerging concepts in molecular structure, chemical reactivity, reaction mechanisms, thermodynamics, kinetics, catalysis, and photochemistry.
- **Advances in modern analytical and computational techniques**, which provide new approaches for investigating molecular structure, reaction mechanisms, and chemical reactivity.
- **Current scientific research and international literature**, particularly recent research publications and developments in related areas of organic chemistry.
- **Industrial and pharmaceutical applications**, which influence the selection of topics related to reaction mechanisms, catalysis, molecular interactions, and chemical reactivity.
- **Environmental and sustainability considerations**, including the development of more efficient, selective, and environmentally responsible chemical processes.
- **National and international academic standards**, which influence course content, learning outcomes, teaching strategies, and assessment methods.
- **Research and technological developments in related disciplines**, including bioorganic, organometallic, supramolecular, polymer, and materials chemistry.

89. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*

* This can include notes on whether the course is basic or optional.

90. Program Description				
Year/Level	**Course Code**	**Course Name**	**Credit Hours**	
Master students	**Phys. Organ. Chem.**	**Physical Organic Chemistry**		**Theoretical 2 hours**

91. Expected learning outcomes of the program	
Knowledge	
Learning Outcomes 1	Upon completion of the course, students will be able to: 1. Demonstrate advanced knowledge of the relationship between **molecular structure and chemical reactivity**. 2. Explain the principles of **molecular bonding, strain, stability, and non-covalent interactions**. 3. Understand the fundamental principles of **thermodynamics and kinetics** as applied to organic reactions. 4. Explain **organic reaction mechanisms, reactive intermediates, energy surfaces, and transition states**. 5. Demonstrate knowledge of **acid–base chemistry, catalysis, and photochemistry**. 6. Recognize the application of physical organic chemistry principles to contemporary areas of chemical research.
Skills	
Learning Outcomes 2	• Analyze and interpret the relationship between **molecular structure and chemical reactivity**. • Apply **thermodynamic and kinetic principles** to analyze organic reactions and reaction mechanisms. • Construct and interpret **energy surfaces and reaction-coordinate diagrams**. • Analyze the effects of structural, electronic, and environmental factors on organic reaction rates and equilibria. • Interpret experimental data related to **thermodynamics, kinetics, catalysis, and photochemistry**.
Learning Outcomes 3	• Apply appropriate experimental and computational approaches to investigate **molecular reactivity and reaction mechanisms**. • Critically analyze scientific literature and communicate physical organic chemistry concepts effectively.
Ethics	

Learning Outcomes 4	• Demonstrate **scientific integrity and honesty** in conducting and reporting experimental and research results. • Apply appropriate ethical and safety principles when conducting chemical experiments and handling chemical substances. • Properly acknowledge and cite scientific sources and avoid **plagiarism, fabrication, and falsification of data**. • Demonstrate professional responsibility in the analysis, interpretation, and presentation of scientific information. • Recognize the importance of **environmental responsibility and sustainable chemical practices** in chemical research.

92. Teaching and Learning Strategies

The **Physical Organic Chemistry** course employs a combination of teaching and learning strategies to develop students' advanced knowledge, analytical skills, and research abilities. The main strategies include:

1. **Interactive Lectures** – Presenting advanced concepts related to molecular structure, bonding, thermodynamics, kinetics, reaction mechanisms, catalysis, and photochemistry, with active student participation.
2. **Problem-Based Learning** – Using problems involving reaction mechanisms, energy surfaces, reaction kinetics, acid–base chemistry, and molecular reactivity to develop analytical and problem-solving skills.
3. **Seminar and Discussion-Based Learning** – Encouraging students to discuss selected topics, interpret scientific concepts, and critically evaluate recent developments in physical organic chemistry.
4. **Research-Based Learning** – Introducing students to current scientific literature and research problems related to molecular structure, chemical reactivity, reaction mechanisms, and modern physical organic chemistry.
5. **Experimental Learning** – Using experimental examples and data related to thermodynamics, kinetics, catalysis, and photochemistry to connect theoretical concepts with practical applications.
6. **Computational and Technology-Enhanced Learning** – Introducing appropriate computational and digital tools to examine molecular structure, reaction pathways, energy surfaces, and chemical reactivity.
7. **Case-Based Learning** – Applying physical organic chemistry principles to real chemical problems and contemporary applications in organic, pharmaceutical, biological, and materials chemistry.
8. **Self-Directed Learning** – Encouraging students to independently consult textbooks, scientific publications, databases, and other reliable academic resources.
9. **Scientific Presentation and Communication** – Developing students' ability to communicate scientific concepts and research findings through seminars, presentations, written reports, and academic discussions.
10. **Collaborative Learning** – Encouraging students to work individually and in groups to analyze problems, discuss scientific literature, and present solutions.

11. **Continuous Feedback** – Providing regular feedback on students' assignments, discussions, presentations, and learning progress to support continuous improvement.

93. Evaluation methods

1-Short exams 2- Homework assignments 3- Semester and final exams for theoretical and practical subjects 4- Small projects within the lesson 5- Presentation of activities 6- Semester and final exams and activities

94. Faculty

Faculty Members

Academic Rank	Specialization Physical Organic Chemistry		Special Requirements/Skills (if applicable)		The number of teaching staff	
	General	Special	Advanced organic synthesis, reaction mechanisms, spectroscopy, research supervision		Staff	Lecturer
Associate Professor		Organic chemistry	Ph.D. in Chemistry / Organic Chemistry		1	

Professional Development

Mentoring new faculty members

Professional development of faculty members

Faculty members are encouraged to participate in workshops, training courses, scientific seminars, conferences, and professional development programs related to Physical Organic Chemistry and modern teaching methodologies. They are also encouraged to engage in scientific research, publish research findings in peer-reviewed journals, develop their

experimental and computational skills, and maintain continuous professional development in accordance with recent advances in the field.

95. Acceptance Criterion

For the Master's Program in Organic Chemistry:

Admission to the Master's Program in Organic Chemistry is based on the admission requirements and regulations established by the Ministry of Higher Education and Scientific Research and the University of Wasit. Applicants must hold a relevant Bachelor's degree in Chemistry or an equivalent qualification from a recognized institution. Admission is subject to the applicable competitive selection procedures, available study places, and the required admission criteria for postgraduate studies. Candidates are selected according to their academic qualifications and performance in accordance with the approved postgraduate admission regulations.

96. The most important sources of information about the program

One of the most important sources of information for the study program is based on the recognized curricula and curricula in colleges and scientific departments in European and American universities, in addition to communicating with institutions and state departments that have chemical cadres to develop study programs in order to graduate students with experience to work in these relevant departments and institutions.

97. Program Development Plan

1- Curriculum Development: Review and update course contents to reflect recent advances in organic chemistry, modern synthetic methods, and emerging research areas.
2- Program Learning Outcomes: Review and update learning outcomes to ensure alignment with the knowledge, skills, and ethical competencies expected of Master's graduates.
3- Teaching and Learning: Introduce active learning, problem-based learning, research-based learning, seminars, and technology-enhanced teaching methods.
4- Assessment Methods: Develop diverse and reliable assessment methods that measure knowledge, practical skills, critical thinking, research ability, and professional ethics.

5- Research Development: Encourage postgraduate students and faculty members to conduct innovative research and publish results in peer-reviewed and internationally indexed journals.
6- Laboratory Development: Improve laboratory facilities and provide access to modern instruments and analytical techniques relevant to organic chemistry research.

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Master students	Phys. Organ. Chem.	Physical Organic Chemistry	Basic	✚	✚	✚	✚	✚	✚	✚		✚	✚	✚	

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

66. Course Name: Physical Organic Chemistry	
67. Course Code: Phys. Organ. Chem.	
68. Semester / Year: Second semester	
69. Description Preparation Date: 1/9/2025	
70.Available Attendance Forms: 1/9/2025	
71.Number of Credit Hours (Total) 2 / Number of Units (Total) 2	
72. Course administrator's name (mention all, if more than one name)	
Email kaljorani@uowasit.edu.iq Kamal Rashid Al Jorani	
73. Course Objectives	
Course Objectives	The course aims to provide students with an advanced understanding of the relationships between molecular structure and chemical reactivity, including molecular bonding, reactive intermediates, and organic reaction mechanisms; to develop their ability to apply thermodynamic, kinetic, and structural principles to analyze organic reactions; and to familiarize them with modern experimental and computational approaches for investigating reactivity and reaction mechanisms. The course also aims to enable students to appreciate the application of physical organic principles to contemporary areas of chemistry and to critically understand current research in the field.
74. Teaching and Learning Strategies	
Strategy	For the **Physical Organic Chemistry** course, the following teaching and learning strategies are appropriate: 1. **Interactive Lectures:** Presenting advanced concepts of molecular structure, bonding, stability, thermodynamics, kinetics, reaction mechanisms, catalysis, and photochemistry.

	2. **Problem-Based Learning:** Using problems related to reaction mechanisms, energy surfaces, kinetic analysis, acid–base chemistry, and molecular reactivity. 3. **Seminar and Discussion:** Assigning selected topics for student presentations and encouraging scientific discussion and critical analysis. 4. **Research-Based Learning:** Reviewing recent scientific literature and connecting course concepts with current research in physical organic chemistry. 5. **Experimental Learning:** Discussing and analyzing experiments related to thermodynamics, kinetics, catalysis, and photochemistry. 6. **Computational Learning:** Using appropriate computational methods and molecular modeling tools to investigate molecular structure, energy surfaces, and chemical reactivity. 7. **Case-Based Learning:** Applying physical organic principles to real chemical problems and contemporary applications. 8. **Self-Directed Learning:** Encouraging students to use textbooks, scientific journals, databases, and other reliable academic resources for independent study. 9. **Collaborative Learning:** Engaging students in group activities, problem solving, scientific discussions, and presentations. 10. **Scientific Communication:** Developing students' ability to communicate scientific concepts through seminars, written reports, presentations, and academic discussions.

75. Course Structure (first semester or second semester)

Week	Hour	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method

1 st	2	Physical Organic Chemistry	Introduction to Structure and Models of Bonding: Quantum Numbers, Atomic Orbitals, and Electronic Configurations	Blended learning	Daily exam and discussion
2 nd	2	Physical Organic Chemistry	Introduction to Structure and Models of Bonding: Molecular Orbital Theory and Bonding of Organic Structures	Blended learning	Daily exam and discussion
3 rd	2	Physical Organic Chemistry	Strain and Stability: Thermochemistry of Stable Molecules: Gibbs Free Energy, Enthalpy, and Entropy	Blended learning	Daily exam and discussion
4 th	2	Physical Organic Chemistry	Strain and Stability: Relationships Between Structure and Energetics: Conformational Analysis and Strain	Blended learning	Daily exam and discussion
5 th	2	Physical Organic Chemistry	Solutions and Non-Covalent Binding Forces: Solvent and Solution Properties and Thermodynamics of Solutions	Blended learning	Daily exam and discussion
6 th	2	Physical Organic Chemistry	Solutions and Non-Covalent Binding Forces: Non-Covalent Binding Forces: Hydrogen Bonding, π Interactions, and Induced-Dipole Interactions	Blended learning	Daily exam and discussion
7 th	2	Physical Organic Chemistry	Acid–Base Chemistry: Brønsted Acid–Base Chemistry: pKa, pH, and Acidity Scales	Blended learning	Daily exam and discussion
8 th	2	Physical Organic Chemistry	Acid–Base Chemistry: Predicting Acid Strength: Electronegativity, Induction, Resonance, and Solvation	Blended learning	Daily exam and discussion
9 th	2	Physical Organic Chemistry	Catalysis: General Principles and Forms of Catalysis	Blended learning	Daily exam and discussion
10 th	2	Physical Organic Chemistry	Catalysis: Brønsted Acid–Base Catalysis and Enzymatic Catalysis	Blended learning	Daily exam and discussion
11 th	2	Physical Organic Chemistry	Energy Surfaces and Kinetic Analyses: Energy Surfaces, Reaction Coordinate Diagrams, and Transition States	Blended learning	Daily exam and discussion
12 th	2	Physical Organic Chemistry	Energy Surfaces and Kinetic Analyses: Transition State Theory, Rate Laws, and Kinetic Analysis	Blended learning	Daily exam and discussion
13 th	2	Physical Organic Chemistry	Experiments Related to Thermodynamics and Kinetics: Kinetic Isotope Effects and Substituent Effects	Blended learning	Daily exam and discussion

14 th **15th**	2		Photochemistry: Photochemical Reactions and Photophysical Processes Exam	Blended learning	Daily exam and discussion Month exam

76. Course Evaluation

- Exam %20
- Assignments (Reports /Quizzes/ Programming Project ….) %10
- Final Examination %70

77. Learning and Teaching Resources

Required textbooks (curricular books, if any)	4. Modern Physical Organic Chemistry. by Eric V. Anslyn and Dennis A. Dougherty. 5. Francis A. **Carey** and Richard J. Sundberg, (Advanced Organic Chemistry, **Part A**: Structure and Mechanisms), 5th Edition. 6. Anslyn, E. V.; Dougherty, D. A. Modern Physical Organic Chemistry. University Science Books, 2006.

	7. Isaacs, N. S. Physical Organic Chemistry, 2nd ed. Pearson/Prentice Hall, 1995. 8. Carey, F. A.; Sundberg, R. J. Advanced Organic Chemistry, Part A: Structure and Mechanisms, 5th ed. Springer, 2007 9. Lowry, T. H.; Richardson, K. S. Mechanism and Theory in Organic Chemistry, 3rd ed. Harper & Row, 1987.
Main references (sources)	Robert T. **Morrison** and Robert N. **Boyd**, (Organic Chemistry), 7th Edition.
Recommended books and references (scientific journals, reports…)	Robert T. **Morrison** and Robert N. **Boyd**, (Organic Chemistry), 7th Edition.
Electronic References, Websites	https://www.sciencedirect.com/search?qs=imidazoles https://www.ncbi.nlm.nih.gov/nlmcatalog/?term=imidazoles https://pubs.acs.org/action/doSearch?AllField=imidazoles https://link.springer.com/search?new-search=true&query=imidazoles https://www.scopus.com/results/results.uri?st1=imidazoles&st2=&s=TITLE-ABS-KEY%28imidazoles%29&limit=10&origin=searchbasic&sort=plf-f&src=s&sot=b&sdt=b&sessionSearchId=61121f665a19a124180f6d46749114a4 https://www.nature.com/search?q=imidazoles&journal= https://www.science.org/action/doSearch?AllField=imidazoles

Second semester
Reaction mechanisms
Prof. Dr Athraa K. Saker

98. Program Vision

Leadership and academic and research excellence in the field of organic chemistry and its " " advanced applications at both national and international levels, while providing an inspiring educational and research environment aligned with global standards to serve society and ".".support sustainable development

99. Program Mission

" ""To prepare specialized and distinguished scientific and research cadres in the field of organic chemistry and its advanced applications by delivering high-quality academic education and rigorous practical and research training based on modern scientific methodologies. The program aims to empower students to solve scientific, industrial, and environmental challenges while adhering to professional ethics and integrity to serve society and support the knowledge-based economy".

".

• Program Objectives

- **Advanced Theoretical Expertise:** Master advanced chemical principles, reaction mechanisms, spectroscopic characterization, and molecular design.
- **Research & Technical Competence:** Design and execute independent research projects using modern synthetic routes, eco-friendly green chemistry methods, and analytical instrumentation.
- **Critical Analysis & Problem-Solving:** Evaluate, interpret, and troubleshoot complex spectroscopic, thermal, and structural data to solve advanced chemical problems.

- **Academic Integrity & Publication:** Conduct research in alignment with international ethical standards and produce high-quality scientific manuscripts suitable for peer-reviewed indexing (e.g., Scopus, Clarivate).
- **Professional & Community Impact:** Apply chemical knowledge to address industrial, environmental, and healthcare challenges while maintaining laboratory safety protocols.

100. Program Accreditation

- **Accreditation Status :**The program is actively pursuing national and international program accreditation and currently complies with the quality assurance and academic accreditation standards established by the Iraqi Ministry of Higher Education and Scientific Research (Science Programs Accreditation Council).
- **Accrediting Body :**The National Council for Accreditation of Science Programs / Supervision and Scientific Evaluation Apparatus – Ministry of Higher Education and Scientific Research.
- **Quality & Enhancement Measures:**
    - Implementing national quality assurance standards for postgraduate programs.
    - Periodically updating curriculum structures and intended learning outcomes (PILOs) in alignment with international academic benchmarks.
    - Conducting regular Program Self-Assessment Reports (SAR) to continuously verify and meet comprehensive accreditation criteria.

101. Other external influences

5. **Labor Market & Industrial Alignment:** Evolving demands of local, national, and regional job markets, specifically the growing need for specialized expertise in pharmaceuticals, petrochemicals, materials science, and chemical manufacturing.
6. **Rapid Technological & Scientific Advances:** Continuous global developments in synthetic methodologies, green chemistry paradigms, nanotechnology, and advanced characterization instruments that necessitate regular curriculum updates.
7. **Governmental & Ministry Regulations:** Policies, statutory directives, admission quotas, and quality control guidelines established by the Ministry of Higher Education and Scientific Research.
8. **Environmental & Health Policies:** National and global sustainability mandates and environmental regulations that drive research toward eco-friendly processes, waste reduction, and green chemistry solutions.
9. **International Academic Standards & Collaboration:** Benchmarks set by international accrediting bodies, global university rankings, and opportunities for collaborative research networks and joint publications
10.

* Remarks	Percentage (%)	Credit Hours	Number of Courses	Program Structure
English Language	%5.5	2	1	**Institution Requirements ((University**
Research Methodology Biostatistics &	%5.5	2	1	**College Requirements**
Advanced Specialized Chemistry Courses	%55.6	20	8	**Department (Requirements (Core**
Not Applicable for .Academic M.Sc	-	-	-	**Summer Training / Internship**
Viva & Research Year Voce Defense	%33.4	12	1	**Others (Master's (Thesis**
Total Requirements for M.Sc. Degree	**%100**	**36**	**11**	**Total**

* This can include notes whether the course is basic or optional.

102. Program Description

Year/Level	Course Code	Course Name	Credit Hours
Master's	CHEM-	mechanism Organic Chemistry	2 hours weekly

103. Expected learning outcomes of the program

A. Knowledge and Understanding:

- **A-1 :**Demonstrate an in-depth understanding of advanced concepts, reaction mechanisms, stereochemistry, and synthetic organic strategies.
- **A-2 :**Comprehend the physical and chemical principles underlying modern spectroscopic and analytical techniques (e.g., NMR, FTIR, Mass Spectrometry, UV-Vis.(
- **A-3 :**Identify modern emerging trends in organic chemistry, including green chemistry practices, organic nanostructures, and catalytic frameworks.

B. Skills:

- **B-1 :**Design and execute multi-step synthetic routes for novel organic and heterocyclic compounds with high efficiency.
- **B-2 :**Analyze and interpret complex spectral, thermal, and experimental data to determine precise molecular structures.

- **B-3 :**Utilize computational tools, modeling software, and scientific databases for research and data retrieval.
- **B-4 :**Prepare and write scientific reports, review papers, and a research thesis according to international academic standards.

C. Values and Responsibilities:

- **C-1 :**Adhere strictly to scientific research ethics, academic integrity, and responsible authorship.
- **C-2 :**Apply chemical safety protocols, risk assessment, and environmentally sustainable practices in laboratory settings.
- **C-3 :**Exhibit autonomous, lifelong learning capabilities, critical thinking, and effective teamwork within collaborative research environments.

104. Teaching and Learning Strategies

7. **Interactive Lectures Continuous & Midterm Assessment :**Periodic written and oral examinations conducted throughout the semester to measure theoretical knowledge and comprehension.
8. **Practical & Laboratory Assessment :**Evaluation of hands-on laboratory performance, accuracy in synthetic/characterization procedures, and practical lab reports.
9. **Assignments & Research Reports :**Assessment of scientific review papers, problem-solving assignments, and critical literature evaluations.
10. **Seminars & Presentations :**Evaluation of the student's ability to present scientific topics and defend research findings in public seminars.
11. **Final Examinations :**Comprehensive end-of-semester written exams assessing course-level intended learning outcomes.
12. **Thesis Evaluation & Defense (Viva Voce :(**Formal review of the Master's research thesis by expert reviewers and an academic examination committee assessing scientific originality and oral defense.

105. Evaluation methods

106. Faculty

Continuous & Midterm Assessment: Periodic written and oral examinations conducted throughout the semester to measure theoretical knowledge and comprehension.

Faculty Members

Academic Rank	Specialization		Special Requirements/Skills (if applicable)		The number of teaching staff	
	General	Special			Staff	Lecturer
Professor.phd	Chemistry	Organic Chemistry				

Professional Development

Mentoring new faculty members

- **Orientation for New Academic Staff:**
  - Conducting induction programs for newly appointed faculty to familiarize them with academic regulations, quality control standards, and laboratory safety protocols.
  - Enrolling new teaching staff in mandatory university-certified pedagogical methods, educational technology, and digital literacy training.
  - Pairing new instructors with senior faculty members (Mentorship Program) to gain guidance in postgraduate research supervision and laboratory management.
- **Professional Development for Faculty:**
  - Engaging faculty in specialized workshops on advanced chemical software, modern spectroscopic instrumentation, and chemical safety management.
  - Encouraging active participation in national and international scientific conferences and collaborative research sabbaticals.
  - Organizing training sessions focused on innovative teaching strategies, digital course design, and writing high-impact research papers for **Scopus** and **Clarivate** indexed journals.

107. **Acceptance Criterion**

The student must be accepted as a graduate of the bachelor of science of chemistry degree, with a minimum average at least 70%.

108. **The most important sources of information about the program**

- **Official Website: The official portal of the College of Science / Wasit University (Department of Chemistry / Postgraduate Studies section).**

- **Postgraduate Program Guide: The official academic handbook issued by the college, containing admission requirements, study plans, and detailed course descriptions.**
- **Ministry Directives & Regulations: Regulatory guidelines issued by the Iraqi Ministry of Higher Education and Scientific Research (Research & Development Department and Quality Assurance Directorate).**
- **Laboratory Safety Manual: Institutional rules and safety protocols governing chemical handling and operations in the department's research laboratories.**
-
- **Scientific Databases & Journals: Scientific digital libraries and databases (e.g., Scopus, ScienceDirect) featuring published research and thesis outputs from the department.**

109. Program Development Plan

6. **Curriculum Modernization :**Periodically updating course contents to integrate emerging paradigms, such as Green Chemistry, Organic Nanotechnology, and eco-friendly catalytic synthesis.
7. **Infrastructure and Laboratory Upgrading :**Modernizing postgraduate research laboratories with advanced characterization instruments (e.g., FTIR, UV-Vis, TGA/DTA) while enhancing chemical safety protocols in line with international standards.
8. **Promoting High-Impact Publications :**Directing Master's research projects toward publishing results in reputable, peer-reviewed journals indexed in **Scopus** and **Clarivate**.
9. **Digital Integration and Software Training :**Incorporating computational tools (e.g., ChemDraw, Gaussian) and advanced spectral analysis software into the training curriculum.
10. **Fostering Research Collaborations :**Building partnerships with national/international research centers and aligning thesis projects with industrial, environmental, and health sector demands to address practical challenges.

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Master's	CHEM-	Mechanism Organic **chemistry**	Basic	✚	✚			✚	✚	✚		✚	✚	✚	

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

78. Course Name:
Mechanism organic chemistry
79. Course Code: Quan. Chem.
CHEM−
80. Semester / Year: first semester/
Second Semester
81. Description Preparation Date:
14\8\2025
82.Available Attendance Forms:
In-person (Attendance-based)
83.Number of Credit Hours (Total) / Number of Units (Total)
30 hours (Total) / 2 Units
84. Course administrator's name (mention all, if more than one name)
Dr. Athra G Sager

Course Structure (First Semester Schedule)

Assessment Method	Teaching Method	Module / Subject Title	Required Intended Learning Outcomes	Hours	Week
Class Discussion	Interactive Lecture	**Thermodynamic & Kinetic** Activation energy, **:Principles** transition states, and energy .profile diagrams	Understand thermodynamic and kinetic fundamentals	2	**1**
Homework Assignment	Lecture & Problem Solving	**Methods for Elucidating** Reactive **:Mechanisms** intermediate isolation, isotopic labeling, and kinetic .control	Comprehend experimental tools for proving mechanisms	2	**2**
Short Quiz	Lecture & Workshop	**& Kinetic Isotope Effects** Linear **:Hammett Equation** ,free-energy relationships parameters, and .steric/electronic factors	Apply linear free-energy relationships and electronic effects	2	**3**
Analytical Problem	Interactive Lecture	**Nucleophilic Substitution :(S_N1, S_N2, S_N_i)** Stereochemical outcomes, solvent effects, and leaving .group abilities	Master nucleophilic substitution mechanisms at carbon sp^3$$	2	**4**

Homework Assignment	Lecture & Practice	**E1, E2,) Elimination Reactions** Zaitsev vs. Hofmann **:(E1cB** rules and stereoelectronic .requirements	Differentiate elimination mechanisms and regioselectivity	2	**5**
Class Discussion	Interactive Lecture	**:Addition Reactions** Mechanistic pathways for alkenes, alkynes, and .conjugated dienes	Analyze electrophilic/nucleophilic additions to unsaturated bonds	2	**6**
Short Quiz	Interactive Lecture	**SEAr,) Aromatic Substitution** complex -α **:(SNAr** intermediates and .benzyne/aryne mechanisms	Understand aromatic substitution mechanisms	2	**7**
Midterm Grade ((20%	Written Exam	**Midterm Examination**	Assess comprehension of core mechanisms	2	**8**
Homework Assignment	Lecture & Examples	**:Carbonyl Group Chemistry** Nucleophilic addition/substitution, esterification, and acid/base-.catalyzed condensations	Study mechanisms of carbonyl group chemistry	2	**9**
Participation Evaluation	Interactive Lecture	**:(Reactive Intermediates (I** Generation, stability trends, and rearrangement pathways of carbocations and .carbanions	Characterize carbocations and carbanions	2	**10**
Short Quiz	Interactive Lecture	**:(Reactive Intermediates (II** Electronic structures (singlet/triplet), insertion, and addition pathways of carbenes .and radicals	Examine carbenes, nitrenes, and free radicals	2	**11**
Short Report Review	Lecture & Seminar	**:Molecular Rearrangements** Wagner-Meerwein, Baeyer-Villiger, Hofmann, and Curtius .rearrangements	Master classic organic rearrangement mechanisms	2	**12**
Analytical Problem	Lecture & Workshop	**:Pericyclic Reactions** Woodward-Hoffmann rules, electrocyclic reactions, and .Diels-Alder cycloadditions	Apply orbital symmetry conservation rules	2	**13**
Report Assessment	Interactive Lecture	**& Hydride Transfer, Redox :Catalytic Cycles** Organocatalysis mechanisms and transition-metal catalytic .cycles	Comprehend hydride transfer, & organocatalysis metal catalysis	2	**14**
Final Assessment	Comprehensive Exam	**Final Examination**	Comprehensive evaluation of	2	**15**

			course learning outcomes		

Distribution of 100 marks based on student tasks:

- **Midterm Written Examination:** 20 Marks
- **Quizzes & Homework Assignments:** 10 Mark
- **Seminar / Scientific Report & Participation:** 10 Marks and then Final 60%

Second semester

Hetocyclic organic compound

Assis. Prof. Dr Ammar Farman Aboud

110. Program Vision

Excellence in teaching chemistry, scientific research, and its applications to contribute to community service

111. Program Mission

Preparing scientific competencies in chemistry to contribute to scientific, industrial, educational, and economic development in the governorate and solving environmental problems through applied research and providing distinguished educational, research, and training services.

112. Program Objectives

The course aims to provide Master's students with an advanced understanding of the **structure, nomenclature, properties, synthesis, reactivity, and reaction mechanisms of heterocyclic compounds**; to develop their ability to analyze and predict the chemical behavior of heterocyclic systems based on electronic structure and aromaticity; to introduce modern synthetic strategies for the preparation and functionalization of heterocyclic compounds; and to enable students to apply heterocyclic chemistry principles to the synthesis of biologically active compounds, pharmaceuticals, and other important organic materials.

113. Program Accreditation

The Master's Program in Organic Chemistry is subject to the academic and quality assurance standards established by the Ministry of Higher Education and

Scientific Research and the University of Wasit, in accordance with applicable national postgraduate education and academic accreditation requirements. The program aims to ensure the quality of teaching, scientific research, learning outcomes, and academic services, and to achieve recognized standards of excellence in higher education. The program awards the degree of Master of Science in Organic Chemistry.

114. Other external influences

The **Heterocyclic Compounds** course is influenced by the following external factors:

1. **Recent developments in heterocyclic chemistry**, including new synthetic methods, reaction mechanisms, and strategies for functionalization of heterocyclic systems.
2. **Advances in pharmaceutical and medicinal chemistry**, particularly the importance of heterocyclic scaffolds in the design and development of biologically active and therapeutic compounds.
3. **Current scientific research and international literature**, including recent publications concerning the synthesis, properties, reactivity, and applications of heterocyclic compounds.
4. **Advances in modern analytical and spectroscopic techniques**, which facilitate the structural identification and characterization of heterocyclic compounds.
5. **Industrial applications of heterocyclic compounds**, particularly in pharmaceutical, agrochemical, materials, and specialty chemical industries.
6. **Green and sustainable chemistry**, including the development of environmentally friendly synthetic methods, efficient reactions, and reduction of hazardous chemical waste.
7. **National and international academic standards**, which influence course content, learning outcomes, teaching strategies, assessment methods, and quality assurance requirements.

115. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*

* This can include notes on whether the course is basic or optional.

116. Program Description				
Year/Level	**Course Code**	**Course Name**	**Credit Hours**	
Master students	**Heterocycl. Comp.**	**Heterocyclic compounds**		**Theoretical 2 hours**

117. Expected learning outcomes of the program	
Knowledge	
Learning Outcomes 1	Upon completion of the course, students will be able to: 1. Demonstrate advanced knowledge of the **structure, nomenclature, classification, and properties of heterocyclic compounds**. 2. Explain the principles governing the **aromaticity, electronic structure, stability, and reactivity** of heterocyclic systems. 3. Understand the major **synthetic methods and reaction mechanisms** used for the preparation of heterocyclic compounds. 4. Explain the chemical behavior and characteristic reactions of important **five- and six-membered heterocyclic systems**. 5. Recognize the importance and applications of heterocyclic compounds in **medicinal, pharmaceutical, industrial, and materials chemistry**.
Skills	
Learning Outcomes 2	Upon completion of the course, students will be able to: 1. Analyze the **structure and reactivity** of heterocyclic compounds based on their electronic and molecular properties. 2. Select appropriate **synthetic routes, reagents, and reaction conditions** for the preparation and functionalization of heterocyclic compounds. 3. Propose and explain reasonable **reaction mechanisms** for heterocyclic synthesis and transformations.

	4. Predict the likely products of reactions involving different heterocyclic systems. 5. Interpret appropriate **spectroscopic and analytical data** for the identification and characterization of heterocyclic compounds.
Learning Outcomes 3	1. Critically evaluate scientific literature related to the synthesis, reactivity, and applications of heterocyclic compounds. 2. Apply heterocyclic chemistry principles to problems related to drug design and biologically active molecules.
Ethics	
Learning Outcomes 4	Upon completion of the course, students will be able to: 1. Demonstrate **scientific integrity and honesty** in conducting and reporting chemical research. 2. Apply appropriate **laboratory safety and responsible chemical-handling practices** when working with heterocyclic compounds. 3. Properly acknowledge and cite scientific sources and avoid **plagiarism, fabrication, and falsification of data**. 4. Demonstrate professional responsibility in the **analysis, interpretation, and presentation of scientific results**. 5. Recognize the importance of **environmental protection and sustainable chemistry** in the synthesis and application of heterocyclic compounds.

118. Teaching and Learning Strategies

The Master's Program in Heterocyclic Compounds adopts a variety of teaching and learning strategies designed to develop advanced knowledge, practical skills, critical thinking, research competence, and ethical professional practice. The main strategies include:

- **Interactive lectures:** Present the fundamental concepts of heterocyclic chemistry, including nomenclature, classification, structure, aromaticity, synthesis, chemical reactions, and mechanisms of heterocyclic compounds.
- **Problem-based learning:** Engage students in solving problems related to the prediction of structures, reaction mechanisms, synthetic pathways, and reactivity of heterocyclic systems.
- **Mechanism-based learning:** Emphasize understanding reaction mechanisms through step-by-step analysis of electrophilic, nucleophilic, cycloaddition, condensation, and substitution reactions.
- **Discussion and active learning:** Encourage student participation through classroom discussions, questions, and comparative analysis of different heterocyclic systems.

- **Molecular structure visualization:** Use molecular models, chemical drawing software, and visual representations to help students understand three-dimensional structures, aromaticity, electronic effects, and conformational properties.
- **Laboratory-based learning:** Where applicable, reinforce theoretical concepts through practical experiments involving the synthesis, purification, and characterization of selected heterocyclic compounds.
- **Case studies and applications:** Introduce pharmaceutical, biological, agricultural, and industrial applications of heterocyclic compounds to demonstrate their relevance to modern chemistry.
- **Independent learning:** Encourage students to consult textbooks, scientific literature, databases, and other reliable resources to develop their ability to obtain and evaluate chemical information independently.
- **Group work and presentations:** Assign students group activities and short presentations on selected heterocyclic compounds, synthetic methods, reaction mechanisms, or their biological applications.
- **Formative assessment and feedback:** Use quizzes, homework, problem-solving exercises, and classroom activities to monitor students' understanding and provide continuous feedback.

119. Evaluation methods

1-Short exams 2- Homework assignments 3- Semester and final exams for theoretical and practical subjects 4- Small projects within the lesson 5- Presentation of activities 6- Semester and final exams and activities

120. Faculty

Faculty Members

Academic Rank	Specialization Heterocyclic compounds		Special Requirements/Skills (if applicable)		The number of teaching staff	
	General	Special	Advanced organic synthesis, reaction mechanisms, spectroscopy, research supervision		Staff	Lecturer
Associate Professor		Organic chemistry	Ph.D. in Chemistry /		1	

			Organic Chemistry			

Professional Development
Mentoring new faculty members
Professional development of faculty members
Faculty members participate in scientific conferences, workshops, training courses, seminars, research activities, and professional development programs to improve their teaching, research, laboratory, technological, and academic skills. They are also encouraged to publish research in peer-reviewed journals and engage in national and international scientific collaboration.

121. Acceptance Criterion

For the Master's Program in Organic Chemistry, you can use the following formal wording:

Admission to the Master's Program in Organic Chemistry is based on the admission requirements and regulations established by the Ministry of Higher Education and Scientific Research and the University of Wasit. Applicants must hold a relevant Bachelor's degree in Chemistry or an equivalent qualification from a recognized institution. Admission is subject to the applicable competitive selection procedures, available study places, and the required admission criteria for postgraduate studies. Candidates are selected according to their academic qualifications and performance in accordance with the approved postgraduate admission regulations.

122. The most important sources of information about the program

One of the most important sources of information for the study program is based on the recognized curricula and curricula in colleges and scientific departments in European and American universities, in addition to communicating with institutions and state departments that have chemical cadres to develop study programs in order to graduate students with experience to work in these relevant departments and institutions.

123. Program Development Plan
1- Curriculum Development: Review and update course contents to reflect recent advances in organic chemistry, modern synthetic methods, and emerging research areas. 2- Program Learning Outcomes: Review and update learning outcomes to ensure alignment with the knowledge, skills, and ethical competencies expected of Master's graduates. 3- Teaching and Learning: Introduce active learning, problem-based learning, research-based learning, seminars, and technology-enhanced teaching methods. 4- Assessment Methods: Develop diverse and reliable assessment methods that measure knowledge, practical skills, critical thinking, research ability, and professional ethics. 5- Research Development: Encourage postgraduate students and faculty members to conduct innovative research and publish results in peer-reviewed and internationally indexed journals. 6- Laboratory Development: Improve laboratory facilities and provide access to modern instruments and analytical techniques relevant to organic chemistry research.

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Master students	Heterocycl. Comp.	Heterocyclic compounds	Basic	✚	✚	✚	✚	✚	✚	✚		✚	✚	✚	

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

85. Course Name: Heterocyclic compounds
86. Course Code: Heterocycl. Compo.
87. Semester / Year: Second semester
88. Description Preparation Date: 1/9/2025
89.Available Attendance Forms: 1/9/2025
90.Number of Credit Hours (Total) 2 / Number of Units (Total) 2
91. Course administrator's name (mention all, if more than one name)
Email kaljorani@uowasit.edu.iq Ammar Ferman Abbood
92. Course Objectives

Course Objectives	Upon successful completion of this course, students will be able to master the systematic nomenclature, classification, and structural elucidation of diverse heterocyclic systems while critically analyzing the interplay between aromaticity, electronic configuration, and reactivity in both π-excessive and π-deficient heteroaromatics; they will develop the capacity to design rational, multi-step synthetic routes using advanced retrosynthetic analysis, cyclization strategies, cycloadditions, and ring-transformation methodologies for the construction of complex heterocyclic scaffolds; furthermore, they will evaluate the pivotal role of heterocyclic moieties as pharmacophores in drug discovery, agrochemicals, and bioactive natural products, correlating structural features with biological function; and finally, through rigorous engagement with primary literature, students will formulate independent research problems, propose robust experimental approaches for the synthesis and characterization of novel heterocyclic targets, and critically assess emerging trends in the field.
93. Teaching and Learning Strategies	
Strategy	9- **Interactive Lectures:** Presenting advanced concepts, theories, reaction mechanisms, synthetic methodologies, and recent developments in organic chemistry through interactive lectures and academic discussions. 10- **Problem-Based Learning:** Providing students with complex organic chemistry problems that require analysis, interpretation, logical reasoning, and application of theoretical knowledge. 11- **Research-Based Learning:** Involving students in independent research activities, including literature review, identification of research gaps, experimental planning, data collection, analysis, and interpretation. 12- **Laboratory-Based Learning:** Developing practical skills through laboratory experiments involving organic synthesis, purification, characterization, and safe handling of chemicals and laboratory equipment. 13- **Self-Directed Learning:** Encouraging students to independently search for, evaluate, and study scientific literature using scientific databases, textbooks, review articles, and other reliable academic resources. 14- **Technology-Enhanced Learning:** Using digital platforms, scientific databases, molecular modeling and computational tools, electronic resources, and appropriate educational technologies to support learning and research.

	15- **Continuous Feedback and Reflective Learning:** Providing regular academic feedback on students' performance and encouraging self-assessment and reflection to improve their knowledge, skills, and research competencies.

94. Course Structure (first semester or second semester)

Week	Hour	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method

1 st	2	Heterocyclic compounds	Heterocyclic Nomenclature	Blended learning	Daily exam and discussion
2 nd	2	Heterocyclic compounds	Structures and Spectroscopic Properties of Aromatic Heterocycles	Blended learning	Daily exam and discussion
3 rd	2	Heterocyclic compounds	Substitutions of Aromatic Heterocycles (Part 1)	Blended learning	Daily exam and discussion
4 th	2		Substitutions of Aromatic Heterocycles (Part 2)	Blended learning	Daily exam and discussion
5 th	2	Heterocyclic compounds	Organometallic Heterocyclic Chemistry	Blended learning	Daily exam and discussion
6 th	2	Heterocyclic compounds	Methods in Heterocyclic Chemistry & Ring Synthesis	Blended learning	Daily exam and discussion
7 th	2		Pyridines, Quinolines, and Isoquinolines	Blended learning	Daily exam and discussion
8 th	2	Heterocyclic compounds	Pyryliums, Pyrones, Benzopyryliums, and Benzopyrones	Blended learning	Daily exam and discussion
9 th	2	Heterocyclic compounds	Diazines	Blended learning	Daily exam and discussion
10 th	2	Heterocyclic compounds	Pyrroles, Furans, and Thiophenes	Blended learning	Daily exam and discussion
11 th	2	Heterocyclic compounds	Indoles, Benzothiophenes, Benzofurans, and Related Systems	Blended learning	Daily exam and discussion
12 th	2	Heterocyclic compounds	Azoles and Benzanellated Azoles	Blended learning	Daily exam and discussion
13 th	2	Heterocyclic compounds	Purines, Bridgehead Compounds, and Polyheteroatom Systems	Blended learning	Daily exam and discussion

14 th **15th**	2	Heterocyclic compounds	Special Topics & Applications Exam	Blended learning	Daily exam and discussion Month exam

95. Course Evaluation

- Exam %20
- Assignments (Reports /Quizzes/ Programming Project ….) %10
- Final Examination %70

96. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1- Joule, J. A., & Mills, K. (2010). Heterocyclic Chemistry (5th ed.). Wiley. 2- Eicher, T., Hauptmann, S., & Speicher, A. (2012). The Chemistry of Heterocycles: Structure, Reactions, Syntheses, and Applications (3rd ed.). Wiley-VCH. 3- Katritzky, A. R., Ramsden, C. A., Joule, J. A., & Zhdankin, V. V. (2010).

	Handbook of Heterocyclic Chemistry (3rd ed.). Elsevier. 4- Gilchrist, T. L. (1997). Heterocyclic Chemistry (3rd ed.). Addison Wesley Longman.
Main references (sources)	1- Joule, J. A., & Mills, K. (2010). Heterocyclic Chemistry (5th ed.). Wiley.
Recommended books and references (scientific journals, reports…)	Robert T. **Morrison** and Robert N. **Boyd**, (Organic Chemistry), 7th Edition.
Electronic References, Websites	https://www.sciencedirect.com/search?qs=imidazoles https://www.ncbi.nlm.nih.gov/nlmcatalog/?term=imidazoles https://pubs.acs.org/action/doSearch?AllField=imidazoles

Second semester
Organic Identification
Assis. Prof. Dr. Jawad Kadem Obaies

124. **Program Vision**
Excellence in teaching chemistry, scientific research, and its applications to contribute to community service

125. **Program Mission**
Preparing scientific competencies in chemistry to contribute to scientific, industrial, educational and economic development in the governorate and solving environmental problems through applied research and providing distinguished educational, research and training services.

126. **Program Objectives**
Understanding identification of chemical compounds using spectroscopic methods

127. **Program Accreditation**
Master of Science in Organic Chemistry

128. **Other external influences**

129. Program Structure				
Program Structure	**Number of Courses**	**Credit hours**	**Percentage**	**Reviews***
Institution Requirements	**One course**	**2 hours**		
College Requirements				
Department Requirements				
Summer Training				
Other				

* This can include notes whether the course is basic or optional.

130.Program Description				
Year/Level	**Course Code**	**Course Name**	**Credit Hours**	
Master student		**Advance organic identification**		**2 hours/week**

131. Expected learning outcomes of the program	
Knowledge	
Learning Outcomes 1	1-The department seeks to choose the best modern scientific methods in delivering new information to students through a distinguished cadre of distinguished people. 2- Providing students with scientific experience through practical training in the department's medical laboratories affiliated with the Ministry of Health
Skills	

Learning Outcomes 2	1-The department aims to graduate scientific cadres capable of working in health and educational institutions, factories, chemical laboratories, and central research laboratories. 2- Building the research and analytical capacity of students 3- Developing their deductive side and teaching them to deal with laboratory equipment
Learning Outcomes 3	Helping the graduated to be able to work in different field confidently.
Ethics	
Learning Outcomes 4	1- Developing the student's ability to understand the specialty and deal with it flexibly 2-Create a state of familiarity with the vocabulary of the specialty 3-Advance responsibility in serving society and the country through this specialty

132. Teaching and Learning Strategies

1-Explanation and clarification through lectures 2-How to display scientific materials using data shows and plasma screens 3-Self-learning through homework assignments 4-Continuous daily and weekly surprise tests 5-Guiding students to some sources to benefit from and expand students' understanding of scientific material 6- Graduation projects 7- Scientific visits 8- Seminars and scientific seminars

133. Evaluation methods

1-Short exams 2- Homework assignments 3- Semester and final exams for theoretical and practical subjects 4- Small projects within the lesson 5- Presentation of activities 6- Semester and final exams and activities

134. Faculty

Faculty Members						
Academic Rank	**Specialization**		**Special Requirements/Skills (if applicable)**		**The number of teaching staff**	
	General	**Special**			**Staff**	**Lecturer**
Assist Professor doctor	Chemistry	Organic Chemistry				

Professional Development
Mentoring new faculty members
Professional development of faculty members
Briefly describe the academic and professional development plan and arrangements for faculty such as teaching and learning strategies, assessment of learning outcomes, professional development, etc.

135. Acceptance Criterion

The student accepted must be graduated with the bachelor of science of chemistry degree, with a minimum average at least 70%.

136. The most important sources of information about the program

One of the most important sources of information for the study program is based on the recognized curricula and curricula in colleges and scientific departments in European and American universities, in addition to communicating with institutions and state departments that have chemical cadres to develop study programs in order to graduate students with experience to work in these relevant departments and institutions.

137. Program Development Plan
1-Developing academic content by deleting, adding, and replacing according to administrative procedures. 2- Using modern teaching methods according to the nature of the subject and the level of the learners from time to time. 3- Using modern assessment methods that the student interacts with and at the same time keeps him away from the atmosphere of boredom and repetition. 4- Field visits to some scientific research institutions related to the subject of the course to consolidate what he learns it in the classroom and learns about the methods directly

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
				✚	✚			✚	✚	✚		✚	✚	✚	

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

97.	Course Name: Advance organic identification
98.	Course Code:
99.	Semester / Year: Second semester/ 2025-2026
100.	Description Preparation Date: 1/9/2025
101.	Available Attendance Forms: presence
102.	Number of Credit Hours (Total) / Number of Units (Total)
Two hours a week	
103.	Course administrator's name (mention all, if more than one name)
Assistant professor Dr Jawad Kadhim Abaies Email: jabaies@uowasit.edu.iq	
104.	Course Objectives
Course Objectives	
105.	Teaching and Learning Strategies
Strategy	Interactivec lectures include explaining the subject and discussion

106. Course Structure (first semester or second semester)

Week	Hour	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method

1 st	2	Understanding principles of spectroscopy and its importance	Identification of organic compounds by spectroscopy and its importance	Lecture	Exam and discussion
2 nd	2	Understanding IR Spectroscopy(theory and principles)	IR spectroscopy	Lecture	Exam and discussion
3 rd	2	Understanding molecular vibrations and IR bands	IR spectroscopy	Lecture	Exam and discussion
4 th	2	Understanding types of molecular vibrations	IR spectroscopy	Lecture	Exam and discussion
5 th	2	Understanding factors effect on vibrational frequency	IR spectroscopy	Lecture	Exam and discussion
6 th	2	Understanding electronic displacement	IR spectroscopy	Lecture	Exam and discussion
7 th	2	Understanding FT-IR spectrum and it's regions	IR spectroscopy	Lecture	Exam and discussion
			IR spectroscopy	Lecture	Exam and discussion
8 th	2	Understanding factors effect on IR spectrum band	IR spectroscopy	Lecture	Exam and discussion
9 th	2	Understanding functional group analysis	NMR spectroscopy	Lecture	Exam and discussion
10 th	2	Understanding NMR Spectroscopy(principles and theory)	Proton NMR spectroscopy	Lecture	Exam and discussion
11th	2	Understanding chemical shift in proton NMR spectra	Proton NMR spectroscopy	Lecture	Exam and discussing
12th	2	Understanding the principle of multiplicity	Proton NMR spectroscopy	Lecture	Exam and discussion

13th	2	Understanding integration in proton NMR spectra	Proton NMR spectroscopy	Lecture	Exam and discussion
14 th	2	Understanding principles and theory of carbon NMR spectroscopy	Carbon NMR spectroscopy	Lecture	Exam or discussion
15 th	2	Understanding and interpretation Carbon NMR spectra	Carbon NMR spectroscopy	Lecture	Exam or discussion

107. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student, such as daily preparation, daily oral, monthly, written and blended exams, reports …. etc

108. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	1. **Spectrometric Identification of Organic Compounds 8th Edition** by Robert M. Silverstein, Francis X. Webster, David J. Kiemle, David L. Bryce . 2. **Principles of Instrumental Analysis 7th Edition** by Douglas A. Skoog, F. James Holler, Stanley R. Crouch.
Recommended books and references (scientific journals, reports…)	**Elementary Organic Spectroscopy "Principles and chemical Application** by Y. R. Sharma, Chand and Company Ltd, New Delhi, India, 2009. **Introduction to Spectroscopy** by Donald L. Pavia , Gary M. Lampman & George S . Kriz. **Structure Determination of Organic Compounds: Tables of Spectral Data 4th ed. 2009 Edition**

	by Ernö Pretsch, Philippe Bühlmann, Martin Badertscher.
Electronic References, Websites	

Second semester
Polymers
Assis. Prof. Dr Zaid M. Abbas

138. **Program Vision**
Excellence in teaching chemistry, scientific research, and its applications to contribute to community service

139. **Program Mission**
Preparing scientific competencies in chemistry to contribute to scientific, industrial, educational and economic development in the governorate and solving environmental problems through applied research and providing distinguished educational, research and training services.

140. **Program Objectives**
• Preparing graduates specialized in chemistry at a distinguished level in academic terms to supply the labor market in the governorate with its needs of specialists in various fields. • Participate in finding solutions to the problems of the local environment and national industries through research and development • To be an expert in providing scientific consultations to concerned parties, and organizing scientific seminars and advanced research seminars in various fields of chemistry. • Keeping pace with modern developments in the field of scientific research, by holding periodic discussion sessions and workshops to keep pace with new developments in scientific research.

- Supporting twinning between the chemistry department at the university and chemistry departments in local and international universities to keep pace with scientific progress and development and to participate in scientific research because of its importance in raising the international rankings of our university.
- Enhancing the skills of faculty members, supporting staff, and workers, by holding periodic discussion sessions, workshops, training courses, and participating in local and international scientific seminars and conferences.
- Preparing qualified human resources to contribute to educational progress in the governorate in particular and in Iraq in general.
- Meeting the department's needs for faculty members by appointing distinguished faculty members as teaching assistants and sending them on scholarship to obtain master's and doctoral degrees from distinguished universities in accordance with the college's future study plan.
- Conducting various scientific research, and linking the department to the community and its surrounding environment.

141. Program Accreditation

Master of Science in Organic Chemistry

142. Other external influences

143. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements				
College Requirements				
Department Requirements				

Summer Training				
Other				

* This can include notes whether the course is basic or optional.

144.Program Description				
Year/Level	**Course Code**	**Course Name**	**Credit Hours**	
Master	**Advanced Polymer**	**Polymer**	**3 theoretical**	

145. Expected learning outcomes of the program	
Knowledge	
Learning Outcomes 1	1-The department seeks to choose the best modern scientific methods in delivering new information to students through a distinguished cadre of distinguished people. 2- Providing students with scientific experience through practical training in the department's medical laboratories affiliated with the Ministry of Health
Skills	
Learning Outcomes 2	1-The department aims to graduate scientific cadres capable of working in health and educational institutions, factories, chemical laboratories, and central research laboratories. 2- Building the research and analytical capacity of students 3- Developing their deductive side and teaching them to deal with laboratory equipment
Learning Outcomes 3	1-helping the graduated to be able to work in different field confidently.
Ethics	
Learning Outcomes 4	1- Developing the student's ability to understand the specialty and deal with it flexibly 2-Create a state of familiarity with the vocabulary of the specialty

	3-Advance responsibility in serving society and the country through this specialty

146. Teaching and Learning Strategies

1-Explanation and clarification through lectures

2-How to display scientific materials using data shows and plasma screens

3-Self-learning through homework assignments

4-Continuous daily and weekly surprise tests

5-Guiding students to some sources to benefit from and expand students' understanding of scientific material

6- Graduation projects

7- Seminars and scientific seminars

147. Evaluation methods

1-Short exams 2- Homework assignments 3- Semester and final exams for theoretical and practical subjects 4- Small projects within the lesson 5- Presentation of activities 6- Semester and final exams and activities

148. Faculty

Faculty Members

Academic Rank	Specialization		Special Requirements/Skills (if applicable)		The number of teaching staff	
	General	Special			Staff	Lecturer
Assistant Prof.	Chem	Organic Polymer	Extensive research		X	

Professional Development

Mentoring new faculty members
Professional development of faculty members
Briefly describe the academic and professional development plan and arrangements for faculty such as teaching and learning strategies, assessment of learning outcomes, professional development, etc.

149. Acceptance Criterion

The student must be accepted as a graduate of the bachelor of science of chemistry degree, with a minimum average at least 70%.

150. The most important sources of information about the program

One of the most important sources of information for the study program is based on the recognized curricula and curricula in colleges and scientific departments in European and American universities, in addition to communicating with institutions and state departments that have chemical cadres to develop study programs in order to graduate students with experience to work in these relevant departments and institutions.

151. Program Development Plan

1-Developing academic content by deleting, adding, and replacing it according to administrative procedures.

2- Using modern teaching methods according to the nature of the subject and the level of the learners from time to time.

3- Using modern assessment methods that the student interacts with and at the same time keeps him away from the atmosphere of boredom and repetition.

4- Field visits to some scientific research institutions related to the subject of the course to consolidate what he learns in the classroom and learns about the methods directly

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
				+	+			+	+	+		+	+	+	

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

109. Course Name: Advanced Polymer Chem	
110. Course Code: Poly	
111. Semester / Year: first semester/ 2025-2026	
112. Description Preparation Date: 01-09-2025	
113. Available Attendance Forms: Presence	
114. Number of Credit Hours (Total) / Number of Units (Total) 3 hrs Theoretical	
115. Course administrator's name (mention all, if more than one name)	
Zaid Mohammed Abbas zabbas@uowasit.edu.iq	
116. Course Objectives	
Course Objectives	1-Raising the level of chemistry in all fields 2-Transferring what is new about these sciences to serve society 3-Raising the economic level of the country 4-Providing relevant institutions and departments with technical and scientific graduates the new ones 5- Joint cooperation with state institutions and the private sector for work Scientific research to solve related problems
117. Teaching and Learning Strategies	
Strategy	Following up on outstanding students, supporting them, and guidi them to build their mental and scientific abilities appropriately with their abilities and orientations in different specializations
118. Course Structure (first semester or second semester)	

Week	Hour	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method

1 st	**2**	Introducing to polymers and their importance	Polymers	Paper lectures	Daily exam and discussion
2 nd	**2**	Introducing to the types of polymers	Polymers	Paper lectures	Daily exam and discussion
3 rd	**2**	Introduction of industrial polymers	Polymers	Paper lectures	Daily exam and discussion
4 th	**2**	Introducing the student to the economic evaluation of the polymer industry	Polymers	Paper lectures	Daily exam and discussion
5 th	**2**	Introducing the student to the types of polymers	Polymers	Paper lectures	Daily exam and discussion
6 th	**2**	Introducing the student to catalytic reactors in polymerization mechanics	Polymers	Paper lectures	Daily exam and discussion
7 th	**2**	Introducing the student to the physical sciences in measuring patent formulas	Polymers	Paper lectures	Daily exam and discussion
8 th	**2**	Introducing the student to the importance of polymers in daily life	Polymers	Paper lectures	Daily exam and discussion
9 th	**2**	Defining the new kid on the extraction of polymers from natural sources	Polymers	Paper lectures	Daily exam and discussion
10 th	**2**	Introducing the new student to plastic surgery and industrial surgery	Polymers	Paper lectures	Daily exam and discussion
11 th	**2**	Introduction to new student mathematical calculations throughout the duration of polymers	Polymers	Paper lectures	Daily exam and discussion
12 th	**2**	Introducing the student to matter and heat in polymer science Industrial drying and crystallization processes	Polymers	Paper lectures	Daily exam and discussion
13 th	**2**	Introducing the student to dehydration and crystallization in solid formations	Polymers	Paper lectures	Daily exam and discussion
14 th	**2**	Introducing the student to gold and industrial polymer waste	Polymers	Paper lectures	Daily exam and discussion
15 th	**2**	Examination	Polymers	Paper lectures	Month exam

119. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student, such as daily preparation, daily oral, monthly, written and blended exams, reports …. etc

120. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Polymer Chemistry **Book by Michael Maskos, Oskar Nuyken, and Sebastian Koltzenburg**
Main references (sources)	
Recommended books and references (scientific journals, reports…)	Principles of polymerization Book by George G. Odian
Electronic References, Websites	**www.chemicalprocessing.com**

Second semester
Research methodology
Prof. Dr. Subhi Abd Alsattar

152. **Program Vision**

Excellence in teaching chemistry, scientific research, and its applications to contribute to community service

153. Program Mission

Preparing scientific competencies in chemistry to contribute to scientific, industrial, educational and economic development in the governorate and solving environmental problems through applied research and providing distinguished educational, research and training services.

154. Program Objectives

1. To introduce students to the latest developments and global research trends in the field of organic chemistry.
2. To develop students' skills in searching for and analyzing reliable scientific sources (peer-reviewed journals and international databases).
3. To train students in preparing, presenting, and discussing a specialized scientific topic in front of faculty members and colleagues.
4. To enhance critical thinking skills and the ability to evaluate the results and conclusions reported in published research.
5. To equip students with scientific writing skills and proper source documentation in preparation for their thesis research.
6. To develop scientific communication and academic discussion skills and commitment to research ethics.

155. Program Accreditation

Master of Science in Organic Chemistry

156. Other external influences

157. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*

Institution Requirements				
College Requirements				
Department Requirements				
Summer Training				
Other				

* This can include notes whether the course is basic or optional.

158. Program Description

Year/Level	Course Code	Course Name	Credit Hours
Master's		Research Methodology	2 hours weekly

159. Expected learning outcomes of the program

Knowledge	
Learning Outcomes 1	1-The department seeks to choose the best modern scientific methods in delivering new information to students through a distinguished cadre of distinguished people. 2- Providing students with scientific experience through practical training in the department's medical laboratories affiliated with the Ministry of Health
Skills	
Learning Outcomes 2	1-The department aims to graduate scientific cadres capable of working in health and educational institutions, factories, chemical laboratories, and central research laboratories. 2- Building the research and analytical capacity of students 3- Developing their deductive side and teaching them to deal with laboratory equipment
Learning Outcomes 3	1-helping the graduated to be able to work in different field confidently.
Ethics	

Learning Outcomes 4	1- Developing the student's ability to understand the specialty and deal with it flexibly 2-Create a state of familiarity with the vocabulary of the specialty 3-Advance responsibility in serving society and the country through this specialty

160. Teaching and Learning Strategies

1-Explanation and clarification through lectures 2-How to display scientific materials using data shows and plasma screens 3-Self-learning through homework assignments 4-Continuous daily and weekly surprise tests 5-Guiding students to some sources to benefit from and expand students' understanding of scientific material 6- Graduation projects 7- Scientific visits 8- Seminars and scientific seminars

161. Evaluation methods

1-Short exams 2- Homework assignments 3- Semester and final exams for theoretical and practical subjects 4- Small projects within the lesson 5- Presentation of activities 6- Semester and final exams and activities

162. Faculty

Faculty Members

Academic Rank	Specialization		Special Requirements/Skills (if applicable)		The number of teaching staff	
	General	Special			Staff	Lecturer
Assistant Professor	Chemistry	Organic Chemistry				

Professional Development
Mentoring new faculty members
Professional development of faculty members
Briefly describe the academic and professional development plan and arrangements for faculty such as teaching and learning strategies, assessment of learning outcomes, professional development, etc.

163. **Acceptance Criterion**
The student must be accepted as a graduate of the bachelor of science of chemistry degree, with a minimum average at least 70%.

164. **The most important sources of information about the program**
One of the most important sources of information for the study program is based on the recognized curricula and curricula in colleges and scientific departments in European and American universities, in addition to communicating with institutions and state departments that have chemical cadres to develop study programs in order to graduate students with experience to work in these relevant departments and institutions.

165. Program Development Plan
1-Developing academic content by deleting, adding, and replacing according to administrative procedures. 2- Using modern teaching methods according to the nature of the subject and the level of the learners from time to time.

3- Using modern assessment methods that the student interacts with and at the same time keeps him away from the atmosphere of boredom and repetition.

4- Field visits to some scientific research institutions related to the subject of the course to consolidate what he learns it in the classroom and learns about the methods directly

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Master's		Research Methodology	Basic	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

121. Course Name:
Research Methodology
122. Course Code: Quan. Chem.
123. Semester / Year: first semester/
Second Semester
124. Description Preparation Date:
13\8\2026
125. Available Attendance Forms:
In-person (Attendance-based)
126. Number of Credit Hours (Total) / Number of Units (Total)
30 hours (Total) / 2 Units
127. Course administrator's name (mention all, if more than one name)
Dr. Subhi A. Hassan
128. Course Objectives
1. To introduce students to the latest developments and global research trends in the field of organic chemistry. 2. To develop students' skills in searching for and analyzing reliable scientific sources (peer-reviewed journals and international databases). 3. To train students in preparing, presenting, and discussing a specialized scientific topic in front of faculty members and colleagues. 4. To enhance critical thinking skills and the ability to evaluate the results and conclusions reported in published research. 5. To equip students with scientific writing skills and proper source documentation in preparation for their thesis research. 6. To develop scientific communication and academic discussion skills and commitment to research ethics.
129. Teaching and Learning Strategies
Strategy Introductory guidance lectures; a workshop on research methods and scientific presentation sk individual supervision by the supervising professor; student presentations; and open group discussion
130. Course Structure (first semester or second semester)

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1st	2	-The ability to describe scientific research -The ability to enhance knowledge	The concept of scientific research Types of knowledge that research contributes to education	Interactive lecture	- discussion
2nd	2	The ability to define the purpose of scientific research -The ability to classify research based on different purposes	Objectives and Types of Scientific Research: Research and Development	Interactive lecture	discussion
3rd	2	Acquiring theoretical and applied concepts in the field of chemistry	Practical examples of types of knowledge, research and development, descriptive knowledge, prediction, improvement, basic research, applied research, evaluative research, and action research.	Theoretical application and discussion	discussion
4th	2	Acquiring the skill of fully engaging with literature in the field of chemistry	Literature review according to Cooley's approach and general review objectives with examples	Interactive lecture	Discussion + Writing a Research Introduction
5th-6th	4	-Skills in writing the introduction to scientific research and the required standards	Standards for Writing Scientific Research: Introduction (The Funnel Shape/CARS Model), including (defining the field, identifying the research gap, and addressing the research gap), Scientific Content, Key Terminology	Theoretical application and discussion	Discussion + Writing a Research Introduction
7th-8th	4	-Complete scientific research writing skills	Methodology: Writing guidelines (methodology, data processing, results, discussion, title, keywords, abstract) with examples	Theoretical application and discussion	Discussion + Writing a Research Introduction
9th	2	Skills in writing scientific reports and research proposals	How to write a research proposal with a comprehensive example of a research proposal	Theoretical application and discussion	discussion
10th	2	The skill of writing scientific reports and scientific research papers	The citation process (purpose and objective), citation styles (APA, MLA, CMOS, IEEE)	Theoretical application and discussion	discussion

			Reviewing processes and tools		
11th	2	The skill of identifying scientific journals and choosing the appropriate type for publication	Scientific journals: definition and purpose – types of journals, advantages and disadvantages – classification of scientific journals	Theoretical application and discussion	discussion
12th	2	Scientific skills in the field of scientific journals	Impact Factor and CiteScore. The main differences between them and how they are calculated	Interactive lecture	discussion
13th	2	Research skills	Predatory magazines: definition and how to identify them	Theoretical application and discussion	discussion
14th	2	Research skills	Hijacked magazines: definition and how to identify them	Theoretical application and discussion	discussion
15th	2	Research skills	How to choose the right journal for publishing research	Theoretical application and discussion	discussion

131. Course Evaluation

Monthly theoretical exams, final exam, discussions, scientific writing, analysis of previously published research

132. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Creswell, J. W., and Creswell, J. D. (2018) Research Design: Qualitative, Quantitative, and mixed methods Approaches. 5th ed., SAGE Publications.
Main references (sources)	Creswell, J. W., and Creswell, J. D. (2018) Research Design: Qualitative, Quantitative, and mixed methods Approaches. 5th ed., SAGE Publications.
Recommended books and references (scientific journals, reports…)	Day, R. A., and Castel, B. (2016). How to Wirte and Publish a SCIENTIFIC Paper. 8th Edition. Greenwood.
Electronic References, Websites	ACS Publications, DOAJ, Zotero, COPE

Second semester
Seminar
Assis. Prof. Dr Aseel Farhan

166. **Program Vision**
Excellence in teaching chemistry, scientific research, and its applications to contribute to community service

167. **Program Mission**
Preparing scientific competencies in chemistry to contribute to scientific, industrial, educational and economic development in the governorate and solving environmental problems through applied research and providing distinguished educational, research and training services.

168. **Program Objectives**
1. To introduce students to the latest developments and global research trends in the field of organic chemistry. 2. To develop students' skills in searching for and analyzing reliable scientific sources (peer-reviewed journals and international databases). 3. To train students in preparing, presenting, and discussing a specialized scientific topic in front of faculty members and colleagues. 4. To enhance critical thinking skills and the ability to evaluate the results and conclusions reported in published research.

5. To equip students with scientific writing skills and proper source documentation in preparation for their thesis research.
6. To develop scientific communication and academic discussion skills and commitment to research ethics.

169. Program Accreditation

Master of Science in Organic Chemistry

170. Other external influences

171. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements				
College Requirements				
Department Requirements				
Summer Training				
Other				

* This can include notes whether the course is basic or optional.

172. Program Description

Year/Level	Course Code	Course Name	Credit Hours
Master's	CHEM-701	Seminar	2 hours weekly

173. Expected learning outcomes of the program

Knowledge

Learning Outcomes 1	1-The department seeks to choose the best modern scientific methods in delivering new information to students through a distinguished cadre of distinguished people. 2- Providing students with scientific experience through practical training in the department's medical laboratories affiliated with the Ministry of Health
Skills	
Learning Outcomes 2	1-The department aims to graduate scientific cadres capable of working in health and educational institutions, factories, chemical laboratories, and central research laboratories. 2- Building the research and analytical capacity of students 3- Developing their deductive side and teaching them to deal with laboratory equipment
Learning Outcomes 3	1-helping the graduated to be able to work in different field confidently.
Ethics	
Learning Outcomes 4	1- Developing the student's ability to understand the specialty and deal with it flexibly 2-Create a state of familiarity with the vocabulary of the specialty 3-Advance responsibility in serving society and the country through this specialty

174. **Teaching and Learning Strategies**

1-Explanation and clarification through lectures 2-How to display scientific materials using data shows and plasma screens 3-Self-learning through homework assignments 4-Continuous daily and weekly surprise tests 5-Guiding students to some sources to benefit from and expand students' understanding of scientific material 6- Graduation projects 7- Scientific visits 8- Seminars and scientific seminars

175. Evaluation methods

1-Short exams 2- Homework assignments 3- Semester and final exams for theoretical and practical subjects 4- Small projects within the lesson 5- Presentation of activities 6- Semester and final exams and activities

176. Faculty

Faculty Members

Academic Rank	Specialization		Special Requirements/Skills (if applicable)		The number of teaching staff	
	General	Special			Staff	Lecturer
Assistant Professor	Chemistry	Organic Chemistry				

Professional Development

Mentoring new faculty members

Professional development of faculty members

Briefly describe the academic and professional development plan and arrangements for faculty such as teaching and learning strategies, assessment of learning outcomes, professional development, etc.

177. Acceptance Criterion

The student must be accepted as a graduate of the bachelor of science of chemistry degree, with a minimum average at least 70%.

178. The most important sources of information about the program

One of the most important sources of information for the study program is based on the recognized curricula and curricula in colleges and scientific departments in European and American universities, in addition to communicating with institutions and state departments that have chemical cadres to develop study programs in order to graduate students with experience to work in these relevant departments and institutions.

179. Program Development Plan
1-Developing academic content by deleting, adding, and replacing according to administrative procedures. 2- Using modern teaching methods according to the nature of the subject and the level of the learners from time to time. 3- Using modern assessment methods that the student interacts with and at the same time keeps him away from the atmosphere of boredom and repetition. 4- Field visits to some scientific research institutions related to the subject of the course to consolidate what he learns it in the classroom and learns about the methods directly

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Master's	CHEM-701	Seminar	Basic	✚	✚			✚	✚	✚		✚	✚	✚	

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

133. Course Name:
Seminar
134. Course Code: Quan. Chem.
CHEM−701
135. Semester / Year: first semester/
Second Semester
136. Description Preparation Date:
13\8\2026
137. Available Attendance Forms:
In-person (Attendance-based)
138. Number of Credit Hours (Total) / Number of Units (Total)
30 hours (Total) / 2 Units
139. Course administrator's name (mention all, if more than one name)
Dr. Aseel Farhan Abdullah
140. Course Objectives
1. To introduce students to the latest developments and global research trends in the field of organic chemistry. 2. To develop students' skills in searching for and analyzing reliable scientific sources (peer-reviewed journals and international databases). 3. To train students in preparing, presenting, and discussing a specialized scientific topic in front of faculty members and colleagues. 4. To enhance critical thinking skills and the ability to evaluate the results and conclusions reported in published research. 5. To equip students with scientific writing skills and proper source documentation in preparation for their thesis research. 6. To develop scientific communication and academic discussion skills and commitment to research ethics.
141. Teaching and Learning Strategies
Strategy Introductory guidance lectures; a workshop on research methods and scientific presentation sk individual supervision by the supervising professor; student presentations; and open group discussion
142. Course Structure (first semester or second semester)

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1st	2	Understanding how the course works and its research sources	Introduction to the Seminar course, its importance, and the mechanism for selecting topics	Introductory lecture	-
2nd	2	Skill in searching scientific databases	Search methods in SciFinder, Scopus, Reaxys, and Web of Science	Lecture + practical application	Direct observation
3rd-4th	4	Formulating the research topic and identifying sources	Selecting the seminar topic and preparing an initial list of sources	Individual supervision	Preliminary report
5th	2	Critical reading skills for research papers	Analyzing and critiquing recent peer-reviewed scientific articles	Workshop	Classroom discussion
6th	2	Skills in preparing scientific presentations	Methods of designing a scientific presentation (slides)	Practical workshop	Evaluation of the presentation draft
7th-13th	14	Presenting and discussing students' topics	Weekly presentations of each student's seminar topic in organic chemistry (reactions, mechanisms, recent applications, etc.)	Presentation and group discussion	Evaluation of the presentation and discussion
14th	2	Review and feedback	Discussing faculty feedback on the submitted reports and presentations	Group discussion	Evaluation of the final report
15th	2	Final evaluation	Submission of the final scientific report and overall semester performance evaluation	Closing discussion	Overall course evaluation

143. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student: evaluation of the presentation and oral performance, a written scientific report on the topic, participation and discussion grade, and commitment to deadlines and scientific integrity in documentation.

144. Learning and Teaching Resources

Required textbooks (curricular books, if any)	There is no fixed required textbook; each student relies on recent research sources related to their chosen topic in organic chemistry.
Main references (sources)	Peer-reviewed research papers and articles published within the last five years in specialized journals such as: Journal of Organic Chemistry, Organic Letters,

	Tetrahedron, and the European Journal of Organic Chemistry.
Recommended books and references (scientific journals, reports…)	March's Advanced Organic Chemistry; Strategic Applications of Named Reactions in Organic Synthesis (Kürti & Czakó).
Electronic References, Websites	ScienceDirect, SciFinder, PubMed, Web of Science, Google Scholar.