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

Academic Program and Course Description for Bologna Process/ Chemistry Department College of Science at Mustansiriyah University Academic Year 2024-2025

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 audit procedures and programs 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.

This guide, in its second version, includes a description of the academic program after updating the subjects and paragraphs of the previous guide in light of the updates and developments of the educational system in Iraq, which included the description of the academic program in its traditional form (annual, quarterly), as well as the adoption of the academic program description circulated according to the letter of the Department of Studies

T 3/2906 on 3/5/2023 regarding the programs that adopt the Bologna Process as the basis for their work.

In this regard, we can only emphasize the importance of writing an academic programs and course description to ensure the proper functioning of the educational process.

Concepts and terminology:

Academic Program Description: The academic program description provides a brief summary of its vision, mission and objectives, including an accurate description of the targeted learning outcomes according to specific learning strategies.

Course Description: Provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the students to achieve, proving whether they have made the most of the available learning opportunities. It is derived from the program description.

Program Vision: An ambitious picture for the future of the academic program to be sophisticated, inspiring, stimulating, realistic and applicable.

Program Mission: Briefly outlines the objectives and activities necessary to achieve them and defines the program's development paths and directions.

Program Objectives: They are statements that describe what the academic program intends to achieve within a specific period of time and are measurable and observable.

Curriculum Structure: All courses / subjects included in the academic program according to the approved learning system (quarterly, annual, Bologna Process) whether it is a requirement (ministry, university, college and scientific department) with the number of credit hours.

Learning Outcomes: A compatible set of knowledge, skills and values acquired by students after the successful completion of the academic program and must

determine the learning outcomes of each course in a way that achieves the objectives of the program.

Teaching and learning strategies: They are the strategies used by the faculty members to develop students' teaching and learning, and they are plans that are followed to reach the learning goals. They describe all classroom and extra-curricular activities to achieve the learning outcomes of the program.

Academic Program Description Form

University Name: **Mustansiriyah University**

Faculty/Institute: **College of Science**

Scientific Department: **Chemistry Department**

Academic or Professional Program Name: **Bachelor degree in chemistry**

Final Certificate Name: **Bachelor degree in chemistry** (**B.Sc. in chemistry**)

Academic System: **Semester**

Description Preparation Date: **24/5/2025**

File Completion Date: **24/7/2025**

Signature:

Head of the Department:

Prof. Dr. Salah Mahdi Majeed Al-Shukri

Date: 17/7/2025

Signature:

Dean assistant of Scientific affairs

Assist. Prof. Dr. Ahmed Mahdi Rehaima

Date: 21/7/2025

The file is checked by:

Department of Quality Assurance and University Performance

Director of the Quality Assurance and University Performance Department:

Signature:

Assist. Prof. Dr. Ali Jasem Alhafiz

Date: 17/7/2025

Approval of the Dean

Prof. Dr. Methaq Talib Gaata

Date: 21/7/2025

1. Program Vision

The Chemistry Department at the College of Science is one of the most prominent scientific departments in the field of chemistry at the level of neighboring countries, distinguished by leadership and innovation in education and scientific research and striving to achieve the highest standards of academic excellence.

2. Program Mission

Provide high-quality education in the field of chemistry, promote scientific research to achieve scientific and technological progress, develop scientific and technical skills among students and contribute to solving environmental and health problems through sustainable education and international strategic partnerships.

3. Program Objectives

1- Promote scientific research in the fields of basic and applied chemistry.
2- Provide high-quality study programs that meet the needs of the labor market.
3- Enhance cooperation with state institutions and the private sector as well as international cooperation through fruitful research partnerships.
4- Integrate sustainable development concepts into curricula to enhance environmental and social awareness, and motivate students to innovate solutions to environmental and health problems.
5- Provide a stimulating educational environment that supports creative thinking and innovation.
6- Provide scientific consultations and analytical services to the local community and industrial companies, which enhances cooperation between the department and the community.

4. Program Accreditation

An Initial approval has been obtained from the Canadian Society for Chemistry (CSC) to award the accreditation program to the Department of Chemistry. The Ministry of Higher Education and Scientific Research was approved that (CSC) is reliable and qualified institute for affording academic accreditation to the chemistry department according to their letter No. C.D 2041 on 6/May/2024 and the letter of Mustansiriyah University, quality assurance and performance evaluation department No. 743 on 20/May/2024.

5. Other external influences

The program is mainly sponsored by the college of science and university presidency.

6. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements	**6**	**12**	2.6%	
College Requirements	2	4	%0.8	
Department Requirements	102 ECTS	**438**	%96	
Summer Training	Elective course			Elective course
Other				

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

1. Program Description

Year/Level	Course Code	Course Name	Credit Hours	
Step First	MU010301101	Qualitative Analytical Chem.	Theory(2)+experimental(2)	8ECTS
	MU010301102	Inorganic Chemistry I	Theory(2)	7ECTS
	MU02	Human Rights&Democracy	Theory(2)	2ECTS
	MU010301103	Labortary Sefty	Theory(2)	4ECTS
	MU04	Computers program	Theory(2)+experimental(1	3
	MU06	Arabic Language	Theory(2)	2ECTS
	MU010301105	Mathematics I	Theory(2)	4ECTS
	MU010301201	Volumetric Analytical Chem.	Theory(2)+experimental(2	8ECTS
	MU010301202	Inorganic Chemistry II	Theory(2)	7ECTS
	MU010301203	Cytology	Theory(2)+experimental(2	5ECTS
	MU010301204	Physics Science	Theory(2)+experimental(2	5ECTS
	MU010301205	Mathematics I	Theory(2)	3ECTS
	MU01	English Language	Theory(2)	2ECTS
	MU010302301	Gravimetric Analytical Chem.	Theory(2)+experimental(2	6ECTS
	MU010302302	Inorganic Chemistry III	Theory(2)+experimental(2	6ECTS
	MU010302303	Thermodynamic chemistry	Theory(2)+experimental(2	6ECTS
	MU010302304	Alphatic organic chemistry	Theory(2)+experimental(2	7ECTS
	MU 11	English Language II	Theory(2)	2ECTS

Step second	MU 14	Computers	Theory(2)	3ECTS
	MU010302401	Seperation methods	Theory(2)+experimental(2	6ECTS
	MU010302402	Inorganic elements Chemistry	Theory(2)+experimental(2	6ECTS
	MU010302403	Thermodynamic of liquids	Theory(2)+experimental(2	7ECTS
	MU010302404	Aromatic organic chemistry	Theory(2)+experimental(2	7ECTS
	MU03	Crimes of the baath regime in iraq	Theory(2)	2ECTS
	MU 16	Arabic Language II	Theory(2)	2ECTS

2. Expected learning outcomes of the program

Knowledge

1- The student is familiar with the basics of chemistry.

2- The program aims to raise students ability to the level of understanding in the field of chemical sciences as it relates to his specialty.

3- Developing and raising the students cognitive abilities

Skills

1. Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in Analytical, Inorganic, Organic and Physical Chemistries.
2. Students will be able to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.
3. Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.
4. Students will be able to clearly communicate the results of scientific work in oral, written and electronic formats to both scientists and the public at large.
5. Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
6. Students will be able to explain why chemistry is an integral activity for addressing social, economic, and environmental problems.
7. Students will be able to function as a member of an interdisciplinary problem solving team.

Ethics

1. Students will appreciate the central role of chemistry in our society and use this as a basis for ethical behavior in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy, health and medicine.

3. Teaching and Learning Strategies

Teaching and learning strategies and methods adopted in the implementation of the program in general.

1- Theoretical lectures

2- Short exam (quiz) after each lecture

3- Conducting scientific discussions

4- Conducting various theoretical researches (short report) during the semester

5- Trying to deal with the scientific material in a way that makes the student highly focused through questions and knowledge exchange between students

4. Evaluation methods

1-Daily (Quiz) and monthly tests
2-Scientific research
3-Conducting discussion sessions for students to determine the extent of their understanding of Subject
4-Conducting two to three exam during the semester and one final exam at the end semester.

Professional Development

Mentoring new faculty members

1- One-on-one mentorship with an advanced faculty mentor. The head of the department assigned new faculty a mentor based on research interests.
2- One-on-one mentorship with a near-peer mentor. The head of department assigned a mentor who is in more of a peer position.
3- Group Mentorship Models. The college also assigned multiple mentors how can remove some of the pressure from the mentor-mentee relationship.

Professional development of faculty members

Working to find development ideas and working to develop scientific courses and laboratories and the practical aspect, for staff members

5. Acceptance Criterion

Admission is central (ministerial) and depends on the students' average and the college's acceptance rate in that year, as our department occupies second place in college admissions, as newly accepted students undergo an oral interview to indicate the extent of their desire to join our department in order to organize statistics for the department.

6. The most important sources of information about the program

1- Methodological books approved by the scientific committee in the department and the committees of the colleges of science.
2- staff lectures
3. Books and enrichment sources/sources in English.
4. Internet websites.

7. Program Development Plan

Searching for modern sources from approved websites, as well as diversity in lecturing methods and using all modern methods used in teaching.

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
1nd year	MU010301101	Qualitative Analytical Chem.	Core	√	√	√	√	√	√	√	√				
	MU010301102	Inorganic Chemistry I	Core	√	√	√	√	√	√	√	√				
	MU02	Human Rights&Democracy	Basic	√	√	√	√	√	√	√	√	√	√	√	√
	MU010301103	Labortary Sefty	suport	√	√	√	√	√	√	√	√	√	√	√	√
	MU04	Computers program	suport	√	√	√	√	√	√	√	√				
	MU06	Arabic Language	Basic	√	√	√	√	√	√	√	√	√	√	√	√
	MU010301105	Mathematics I	suport	√	√	√	√	√	√	√	√				
	MU010301201	Volumetric Analytical Chem.	Core	√	√	√	√	√	√	√	√				
	MU010301202	Inorganic Chemistry II	Core	√	√	√	√	√	√	√	√				
	MU010301203	Cytology	suport	√	√	√	√	√	√	√	√				
	MU010301204	Physics Science	suport	√	√	√	√	√	√	√	√				
	MU010301205	Mathematics I	suport	√	√	√	√	√	√	√	√				

	MU01	English Language	Basic	√	√	√	√	√	√	√	√				
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**	
2^{nd} year	MU010302301	Gravimetric Analytical Chem.	Core	√	√	√	√	√	√	√	√					
	MU010302302	Inorganic Chemistry III	Core	√	√	√	√	√	√	√	√					
	MU010302303	Thermodynamic chemistry	Core	√	√	√	√	√	√	√	√	√	√	√	√	
	MU010302304	Alphatic organic chemistry	Core	√	√	√	√	√	√	√	√	√	√	√	√	
	MU 11	English Language II	Basic	√	√	√	√	√	√	√	√					
	MU 14	Computers	suport	√	√	√	√	√	√	√	√	√	√	√	√	
	MU010302401	Seperation methods	Core	√	√	√	√	√	√	√	√					
	MU010302402	Inorganic elements Chemistry	Core	√	√	√	√	√	√	√	√					
	MU010302403	Thermodynamic of liquids	Core	√	√	√	√	√	√	√	√					
	MU010302404	Aromatic organic chemistry	Core	√	√	√	√	√	√	√	√					
	MU03	Crimes of the baath regime in iraq	Basic	√	√	√	√	√	√	√	√					
	MU 16	Arabic Language II	Basic	√	√	√	√	√	√	√	√					

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

Course Description of
Year I

1. Course Name:
Qualitative Analytical Chem.
2. Course Code:
MU010301101
3. Semester / Year:
Semester I (2025-2024)
4. Description Preparation Date:
19/1/2025
5. Available Attendance Forms:
Weekly attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
155 hr (Lectures) + 45 hr (Laboratory classes)
7. Course administrator's name (mention all, if more than one name)
Dr. Muntadhar Salih Sultan muntadhar_sultan@uomustansiriyah.edu.iq

8. Course Objectives	
Course Objectives	1. Understand the basic concepts of analytical chemistry 2. To develop problem solving skills and understanding of the basic theory about most important topic in Analytical Chemistry. 3. Knowing and understanding the basics and principles of chemistry, especially Qualitative and Quantitative analysis. 4. Learn about the Mole concept and laws of the concentration of the compounds. 5. This course including the details about the types of concentrations. 6. Learn about the principles, procedures, and techniques used in analytical analysis. 7. Learn about some important laws in acid and base theories in chemistry. 8. This course deals with the basic concept of buffer solution. Understanding acid base titration

9. Teaching and Learning Strategies	
Strategy	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. .1 Recognize the basic information about the types of analytical chemistry. .2 List the various terms associated with analytical chemistry. .3 Classification the types of solutions based on amount of solute and based on particle size of solute. . .4 Discuss all the Stoichiometric Calculations . .5 A detailed explanation of the concept of the mole and how to calculate it. .6 Define all chemical concentrations with examples and mention their properties for all the types. .7 Explain the Buffer solutions . .8 Explain the acid-base theory for the solutions . 9. A detailed explanation of the p-Function and how to calculate it.

10. Course Structure

Week	Hours	Required Learning Outcomes	Learning method	Evaluation method
1	5	Introduction to analytical chemistry, classification, historical view	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
2	5	Solutions, the chemical composition of solutions	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
3	5	Stoichiometric Calculations, mole Concept	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
4	5	Methods of expressing concentrations	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
5	5	Molarity, Formality	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
6	5	Normality	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
7	5	Concentration by percent	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
8	5	Exam 1	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
9	5	Concentration in parts per thousand or million or billion	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
10	5	Mole fraction concentration	Lectures, Laboratory classes	Quizzes, assessments, exams, reports

11	5	p- Function	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
12	5	Acid-Base Theories	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
13	5	Acid-Base Equilibria	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
14	5	Buffer solutions	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
15		Revision and assignments		

11. Course Evaluation

Theory (quizzes + assessments + activities + reports + exams) = 50%
Laboratory classes = 10%
Final exam = 40%

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	1. Christian, G.D., Dasgupta, P.K. and Schug, K.A., 2013. Analytical chemistry. John Wiley & Sons. 2. Skoog, D.A., West, D.M., Holler, F.J. and Crouch, S.R., 2013. Fundamentals of analytical chemistry. 3. JAMES N MILLER, M.I.L.L.E.R., 2010. Statistics and Chemometrics for Analytical Chemistry
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

13. The most important sources of information about the program

Christian, G.D., Dasgupta, P.K. and Schug, K.A., 2013. Analytical chemistry. John Wiley & Sons.

14. Program Development Plan

Developing teaching methods such as group projects, case studies linked to the objectives of the module.

1. Course Name:	
Inorganic chemistry I	
2. Course Code:	
3. Semester / Year:	
Semester I/ 2024-2025	
4. Description Preparation Date:	
19/1/2025	
5. Available Attendance Forms:	
Weekly Attendance	
6. Number of Credit Hours (Total) / Number of Units (Total)	
130 hr (Lectures) + 45 hr (Laboratory classes)	
7. Course administrator's name (mention all, if more than one name)	
Name: Sarab Mahdi Salih Email: Sarabmahdi@uomstansiriyah.edu.iq	
8. Course Objectives	
Course Objectives	1. To develop problem solving skills and understanding of the basic theory about most important topic in an inorganic chemistry. 2. Knowing and understanding the basics and principles of chemistry, especially atomic structure and periodic table. 3. Learn about the application of the concepts and laws of properties of atoms and molecules. 4. Learn about the principles, procedures, and techniques used in chemical analysis. 5. Learn about some important laws in quantum theories in chemistry. 6. This course deals with the basic concept of electromagnetic radiation. 7. This course including the details about the periodic table and its chemical properties. 8. To understand the concept of term symbol and their problem.

	9. Enabling students to obtain and know all the terms of chemistry

9. Teaching and Learning Strategies	
Strategy	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. .1 Recognize the basic information about the atom and its structure. .2 List the various terms associated with atomic stracture. .3 Summarize the historical theory about electromagnetic radiation. .4 Discuss all spectrum of electromagnetic radiation .5 Discuss the quantum theory. .6 Define black body and its radiation and explain all laws that relative the radiation of black body. .7 Identify all chemical bonds with example and mention their properties condition for all type of bonds. .8 Discuss polarization of ionic compound. .9 Discuss the Lewis dot structure and formal charge for most compounds . .10 Explain the three theory about how the chemical bond form between two atoms 11. Identify the structure of benzene ring

10. Course Structure

Week	Hours	Required Learning Outcomes	Learning method	Evaluation method
1	5	Introduction – basic information, atomic structure, isotopes,	Lectures, Laboratory classes	Discussion and reports
2	5	quatum theory of light, electromagnetic radiation, spectrum of EM, photoelectric effect	Lectures, Laboratory classes	Discussion and reports
3	5	Black body, theory of black body radiation, work function, atomic spectra, emission of hydrogen atom.	Lectures, Laboratory classes	Discussion and reports
4	5	Bohrs theory, radius of hydrogen, velocity , energy,	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
5	5	Wave mechanic theory, quantum number	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
6	5	Types of atomic orbitals, electron configuration, type of electron , periodic table	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
7	5	Mid-term Exam	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
8	5	Classification of element, term symbol	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
9	5	periodic properties	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
10	5	slater rule		
11	5	Electronegativity	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
12	5	atomic size	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
13	5	Electron infinity	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
14	5	Ionization energy	Lectures, Laboratory classes	Quizzes, assessments, exams, reports

15		preparatory week before the final Exam		

11. Course Evaluation	
Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, dailyoral, monthly, or written exams, reports ....etc	
12. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Main references (sources)	1. Inorganic Chemistry"by Gary l. Miessler, Donald A. Tarr(3rd ed ,2003) 2. Inorganic Chemistry principles of structure and reactivity 4th ed, by James E. Huhhey et al, Harper Collins college Puplishers (1993) 3. Shriver & Atkins' Inorganic Chemistry,by Atkins, Overton, RourkeWeller, Armstrong, 4th ed,Oxford (2006),
Recommended books and references (scientific journals, reports…)	4. General chemistry,Whitten, K. W., Davis, R. E., Peck , M. L., and Stanley, G. G.,(2004).7th Ed. Thomson/Brooks/Cole.,. 5. Inorganic Chemistry, ,Prem Dhawan,2008
Electronic References, Websites	

1. Course Name:

Inorganic chemistry2

2. Course Code:

MU010301202

3. Semester / Year:

Semester I /2024-2025

4. Description Preparation Date:

19-09-2024

5. Available Attendance Forms:

Weekly Attendance

6. Number of Credit Hours (Total) / Number of Units (Total)

130 hr (Lectures) + 45 hr (Laboratory classes)

7. Course administrator's name (mention all, if more than one name)

Sarab Mahdi Salih e-mail sarabmahdi@uomstansiriyah.edu.iq

8. Course Objectives

Course Objectives	.1 To develop problem solving skills and understanding of the basic theory about most important topic in an inorganic chemistry. .2 Knowing and understanding the basics and principles of chemistry, especially atomic structure and periodic table. .3 Learn about the application of the concepts and laws of properties of atoms and molecules. .4 Learn about the principles, procedures, and techniques used in chemical analysis. .5 Learn about some important laws in quantum theories in chemistry. .6 This course deals with the basic concept of electromagnetic radiation. .7 This course including the details about the periodic table and its chemical properties . 8. To understand the concept of term symbol and their problem.

9. Teaching and Learning Strategies

Strategy	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study wee .1 Recognize the basic information about the atom and its structure. .2 List the various terms associated with atomic structure. .3 Summarize the historical theory about electromagnetic radiation. .4 Discuss all spectrum of electromagnetic radiation .5 Discuss the quantum theory. .6 Define black body and its radiation and explain all laws that relative the radiation of black body. .7 Identify all chemical bonds with example and mention their properties condition for a type of bonds. .8 Discuss polarization of ionic compound.

	.9 Discuss the Lewis dot structure and formal charge for most compounds . .10 Explain the three theory about how the chemical bond form between two atoms 11. Identify the structure of benzene ring

10.Course Structure

Week	Hours	Required Learning Outcomes	Learning method	Evaluation method
1	3h Lec.	Chemical bond: Definition of chemical bond, types of chemical bond	Lecture & Lab	Reactive Lecture Quizzes, Reports Assessment Monthly exam
2	3h Lec.	Ionic bond, requirement condition for ionic bond, properties of ionic compound	Lecture & Lab	Reactive Lecture Quizzes, Reports Assessment Monthly exam
3	3h Lec.	types of electrons, lattice energy, Born Lande equation, Bonrn- Hyber cycle	Lecture & Lab	Reactive Lecture Quizzes, Reports Assessment Monthly exam
4	3h Lec.	Solubility of ionic compound: Mechanism of ionic compound, solubility,	Lecture & Lab	Reactive Lecture Quizzes, Reports Assessment Monthly exam
5	3h Lec.	hydration and solvation of compound	Lecture & Lab	Reactive Lecture Quizzes, Reports Assessment Monthly exam
6	3h Lec.	Polarization: definition of polarization, Fajians rules	Lecture & Lab	Reactive Lecture Quizzes, Reports Assessment Monthly exam
7	3h Lec.	Mid-term Exam	Lecture & Lab	Reactive Lecture Quizzes, Reports Assessment Monthly exam
8	3h Lec.	Covalent bond: properties of covalent compound, types of covalent bond, coordination bound, metallic bond	Lecture & Lab	Reactive Lecture Quizzes, Reports Assessment Monthly exam
9	3h Lec.	Lewis dot structure: definition of lewis dot structure with examples	Lecture & Lab	Reactive Lecture Quizzes, Reports Assessment Monthly exam

10	3h Lec.	Octet rule, expectation to the octet rule, resonance, and formal charge.	Lecture & Lab	Reactive Lecture Quizzes, Reports Assessment Monthly exam
11	3h Lec.	Theory of bonding: the valance bond theory, hybridization, assumption and limitation of VBT theory.	Lecture & Lab	Reactive Lecture Quizzes, Reports Monthly exam
12	3h Lec.	Molecular orbital theory, types of overlapping atomic orbital. S-S overlapping, P-P overlapping	Lecture & Lab	Reactive Lecture Quizzes, Reports Assessment Monthly exam
13	3h Lec.	valence shell electron pair repulsion, assumption and limitation, steric number	Lecture & Lab	Reactive Lecture Quizzes, Reports Assessment Monthly exam
14	3h Lec.	Bond angle, localized and delocalized electron, Kekule structure of benzene ring.	Lecture & Lab	Reactive Lecture Quizzes, Reports Assessment Monthly exam
15	3h Lec.	**preparatory week before the final Exam**	Lecture & Lab	Reactive Lecture Quizzes, Reports Assessment Monthly exam

11. Course Evaluation

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

12. Learning and Teaching Resources

Main references (sources)	1. Inorganic Chemistry"by Gary l. Miessler, Donald A. Tarr(3rd ed ,2003) 2. Inorganic Chemistry principles of structure and reactivity 4th ed, by James E. Huhhey et al, Harper Collins college Puplishers (1993) 3. Shriver & Atkins' Inorganic Chemistry,by Atkins, Overton, RourkeWeller, Armstrong, 4th ed,Oxford (2006),
Recommended books and references (scientific journals, reports…)	4. General chemistry,Whitten, K. W., Davis, R. E., Peck , M. L., and Stanley, G. G.,(2004).7th Ed. Thomson/Brooks/Cole.,. 5. Inorganic Chemistry, ,Prem Dhawan,2008

13.The most important sources of information about the program
Atkins' Physical Chemistry by Peter Atkins, Julio de Paula, James Keeler.

14.Program Development Plan
Developing teaching methods such as group projects, case studies linked to the objectives of the module.

1. Course Name:
Volumetric Analytical Chem.
2. Course Code:
MU010301201
3. Semester / Year:
Semester I (2024-2025)
4. Description Preparation Date:
19/1/2025
5. Available Attendance Forms:
Weekly attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
155 hr (Lectures) + 45 hr (Laboratory classes)
7. Course administrator's name (mention all, if more than one name)
Muntadhar Salih Sultan e-mail muntadhar_sultan@uomustansiriyah.edu.iq

8. Course Objectives	
Course Objectives	.1 Understand the basic concepts of volumetric analysis .2 To develop problem solving skills and understanding of the basic theory about most important topic in acid base titrations. .3 Knowing and understanding the basics and principles of chemistry, especially precipitation titration analysis. .4 Learn about the complexation reaction and titrations and there applications. .5 This course including the details about the types of titrations. 6. Learn about the principles, procedures, and techniques used in redox reactions and titration analysis.

1. Course Name:
Mathematics 1&2
2. Course Code:
MU010301105
3. Semester / Year:
Semester II (2024-2025)

4. Description Preparation Date:
19/1/2025
5. Available Attendance Forms:
Weekly
6. Number of Credit Hours (Total) / Number of Units (Total)
100 hr (Lectures)
7. Course administrator's name (mention all, if more than one name)
Laheeb Muhsen Noman e-mail Laheeb_muhsen@uomustansiryah.ed.iq

8. Course Objectives	
Course Objectives	At the end of the first course, the students are expected to learn some skills about the basic rules on calculus. At the end of the second course, students are expected to develops them skills about the calculus also learn skills in derivative and the integration.

9. Teaching and Learning Strategies	
Strategy	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. .1Recognize about the basic rules in calculus .2Develop skills about the following: a) The sets with the Inequalities and Absolute value b)The functions which contains Domain and Rang, Cartesian plane, Equations of straight line, Operation on functions, Trigonometric functions, Logarithmic functions, The exponential functions c) Limits and Infinite limits also apply them on the Continuity .3Detailed study on Derivatives with its application 4. Detailed study of definite and indefinite Integrals with some methods of integration

10.Course Structure

Week	Hours	Required Learning Outcomes	Learning method	Evaluation method
1	2	The sets	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
2	2	Inequalities	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
3	2	Intervals	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
4	2	Absolute value	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
5	2	Domain and Rang	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
6	2	Cartesian plane	Lectures, Laboratory classes	Quizzes, assessments, exams, reports

7	2	Equations of straight line	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
8	2	The functions	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
9	2	Operation on functions	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
10	2	Trigonometric functions	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
11	2	Logarithmic functions	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
12	2	The exponential functions	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
13	2	Limits	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
14	2	Infinite limits	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
15	2	Continuity		

11. Course Evaluation

Theory (quizzes + assessments + activities + reports + exams) = 40%
Med. exam= 10%
Final exam = 50%

12. Learning and Teaching Resources

1. Course Name:

Cell biology

2. Course Code:

MU010302402

3. Semester / Year:

Semester II/ 2024-2025

4. Description Preparation Date:

19/1/2025

5. Available Attendance Forms:

Weekly Attendance

6. Number of Credit Hours (Total) / Number of Units (Total)

80 hr (Lectures) + 45 hr (Laboratory classes) l

7. Course administrator's name (mention all, if more than one name)

Yasir Hussein Zaidan e-mail yasir.aljuraisy@yahoo.com

8. Course Objectives

Course Objectives	**The main objectives of the course is to learn:** **1. Introduction of cell biology and overview of the cell** **2. The basic features of cells** **3. The cell structure and function**

	4. The basic structure of typical prokaryotic and Eukaryotic cell **5. Membrane structure and cell transport** **6. Cell metabolism and their chemical reactions** **7. Membrane organelles structure and their chemical and biological activities** **8. Genetic material as the fundamental material for the cells**

9. Teaching and Learning Strategies

Strateg	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. .1 Understand the basic unit of life: the cell and its discovery impact .2 Understand the structure of the cell . .3 Recognize and differentiate between the organelles found in different types of cells .4 Differentiate between different types of cells and their functions . .5 Describe and understand the difference between prokaryotic and Eukaryotic cells. 6. Understand the basic structures and organelles inside the cell and their functions

10. Course Structure

Week	Hours	Required Learning Outcomes	Learning method	Evaluation method
1	5	Introduction: cell biology, the cell and overview	Lectures, Laboratory classes	Questions and discussion
2	5	cell structure and function	Lectures, Laboratory classes	Questions and discussion
3	5	Prokaryotic and eukaryotic cells	Lectures, Laboratory classes	Questions and discussion
4	5	Biochemistry of the cell: Macromolecules	Lectures, Laboratory classes	Questions and discussion
5	5	Membrane Structure and Function	Lectures, Laboratory classes	Questions and discussion
6	5	Movement of Solutes	Lectures, Laboratory classes	Questions and discussion
7	5	Cytoplasmic Membrane Systems/ER/Golgi	Lectures, Laboratory classes	Questions and discussion
8	5	Exocytosis/Endocytosis, Coated Vesicles, Lysosomes, Peroxisomes	Lectures, Laboratory classes	Questions and discussion

9	5	Cytoskeleton	Lectures, Laboratory classes	Questions and discussion
10		Cellular Movement	Lectures, Laboratory classes	Exam
11	5	Aerobic Respiration, ATP production/Mitochondrion	Lectures, Laboratory classes	Questions and discussion
12	5	Chloroplast/Photosynthesis	Lectures, Laboratory classes	Questions and discussion
13	5	Nucleus	Lectures, Laboratory classes	Questions and discussion
14	5	Nucleic acid structures	Lectures, Laboratory classes	Questions and discussion
15	3	**Preparatory week before the final Exam**		

11.Course Evaluation	
Distributing the score out of 100 according to the tasks assigned to the student such as class activity, Quiz written exams, reports ....etc	
12. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Main references (sources)	Basic Cell and Molecular Biology 4e: What We Know and How Found Out. Gerald Bergtrom, University of Wisconsin – Milwaukee ISBN; 978-0-9961502-5-5 Publication Date, 1- 2020 https://dc.uwm.edu/cgi/viewcontent.cgi?article=1011&context=biosci_facbooks_bergtrom
Recommended books and references (scientific journals, reports...)	Molecular Cell Biology, By Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, Angelika Amon and Kelsey C. Martin.2016 https://www.vet-ebooks.com/molecular-cell-biology-8th-edition-pdf/
Electronic References, Websites	

1. Course Name:
Physics sciences
2. Course Code:
MU010302403

3. Semester / Year:
Semester II/ 2024-2025
4. Description Preparation Date:
19/1/2025
5. Available Attendance Forms:
Weekly Attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
80 hr (Lectures) + 45 hr (Laboratory classes) l
7. Course administrator's name (mention all, if more than one name)
Dr. Ehssan Salah Hassan e-mail ehsanphysicyan@uomustansiriyah.edu.iq
8. Course Objectives

Course Objectives	**1. To develop problem solving skills and understanding of magnetism theory through the application of techniques.** **2. To understand Magnetic field, Magnetic field line, Ampere' Law and Magnetic Field of a Moving Charge from a given Magnetic field line.** **3. This course deals with the basic concept of magnetic and electricity.** **4. This is the basic subject for all magnet and magnetic phenomena.** **5. To understand magnetic field direction and faradays Laws problems.** **6. To perform mesh and Nodal analysis.**

9. Teaching and Learning Strategies	
Strategy	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. .1 Recognize how memetic theory works in magnetism. .2 List the various terms associated with magnetism. .3 Summarize what is meant by a basic magnetism. .4 Discuss the reaction and involvement of atoms in magnetism. .5 Describe magnetic field, charge, and Solenoid. .6 Define Ohm's law. .7 Identify the basic magnetic elements and their applications . .8 Discuss the operations of Sources of the Magnetic Field. .9 Discuss the various properties of resistors, capacitors, and inductors. 10. Explain the two Faraday's Law of Induction and Lenz's Law Motional EMF.

10. Course Structure				
Week	**Hours**	**Required Learning Outcomes**	**Learning method**	**Evaluation method**
1	5	Magnetism , Magnetic field line	Lectures, Laboratory classes	Questions and discussion
2	5	Magnetic fields and forces, Right hand rule.	Lectures, Laboratory classes	Questions and discussion
3	5	Magnetic Flux and Gauss's Law for Magnetism, Motion of Charged Particles in a Magnetic Field.	Lectures, Laboratory classes	Questions and discussion
4	5	Ampere' Law, Solenoid,	Lectures, Laboratory classes	Questions and discussion
5	5	Sources of Magnetic Fields, Magnetic Field of a Moving Charge	Lectures, Laboratory classes	Questions and discussion
6	5	Magnetic Field Surrounding a Thin Straight Conductor, Magnetic Field Due to a Curved Wire Segment	Lectures, Laboratory classes	Questions and discussion
7	5	Magnetic Field on the Axis of a Circular Current Loop, The Magnetic Force between Two Parallel Conductors	Lectures, Laboratory classes	Questions and discussion
8	5	EXAM 1	Lectures, Laboratory classes	Questions and discussion
9	5	Faraday's Law of Induction, Induced emf and Electric Fields, Lenz's Law.	Lectures, Laboratory classes	Questions and discussion
10		Motional EMF, Self-Inductance	Lectures, Laboratory classes	Exam
11	5	RL Circuits, Energy in a Magnetic Field	Lectures, Laboratory classes	Questions and discussion
12	5	Mutual Inductance, Oscillations in an LC Circuit	Lectures, Laboratory classes	Questions and discussion
13	5	Revision problem classes.	Lectures, Laboratory classes	Questions and discussion
14	5	The RLC Circuit, AC Sources	Lectures, Laboratory classes	Questions and discussion

15	3	Resistors in an AC Circuit, Inductors in an AC Circuit		

11.Course Evaluation	
Distributing the score out of 100 according to the tasks assigned to the student such as class activity, Quiz written exams, reports ....etc	
12. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Electricity and magnetism R. MURUGESHAN, S. CHAND & COMPANY LIT, 1995.
Main references (sources)	Elecrisity and magnetism /3rd Edition/ EDWARED M. PURCELL AND DAVID J. MORIN, 2015.
Recommended books and references (scientific journals, reports...)	Seraway Solutions, Instructions Manual for Serway and Jewet Physics for Scientists and Engineers.
Electronic References, Websites	Seraway Solutions, Instructions Manual for Serway and Jewet Physics for Scientists and Engineers.

Course Description of Year II

1.Course Name:
Gravimetric Analytical Chem.
2.Course Code:
MU010302301
3.Semester / Year:
Semester I (2024-2025)
4.Description Preparation Date:
19/1/2025
5.Available Attendance Forms:
Weekly attendance
6.Number of Credit Hours (Total) / Number of Units (Total)
120hr (Lectures) + 30 hr (Laboratory classes)
7.Course administrator's name (mention all, if more than one name)
Dr. Raghad Al-Salhi alsalhi.r@uomustansiriyah.edu.iq

8.Course Objectives	
Course Objectives	**1 .Understand the fundamental principles of gravimetric analysis** **2 .Provide students with the knowledge and skills needed to accurately and reliably determine the quantity of a specific substance in a sample** **3 .Learn the steps involved in a gravimetric procedure** **4 .Acquire a deep understanding of the characteristics of both the precipitate and the reagent causing precipitation**

	5 .Perform calculations in gravimetric analysis **6 .Learn about solubility and understand how substances dissolve in various solvents and the factors that influence the solubility** **7. Gain knowledge in several statistical techniques used for evaluating the reliability of chemical analysis**

9 .Teaching and Learning Strategies	
Strategy	1 .Enhance the analytical thinking and problem-solving abilities in quantitative analysis 2 .Learn how to selectively separate specific component from complex mixtures using suitable precipitating agents 3 .Gain a deeper understanding of stoichiometry and precipitation reactions 4 .Understand mechanism of precipitation to avoid impurity interference 5 .Gain expertise in converting mass measurements into quantitative results 6 .Understand the principles of solubility, the interactions between solute and solvent components, as well as the factors that influence these interactions 7. Learn a variety of statistical tests for assessing the quality of analytical data

10.Course Structure

Week	Hours	Required Learning Outcomes	Learning method	Evaluation method
1	4	Gravimetric analysis overview -Types of gravimetric analysis: precipitation gravimetry, volatilization gravimetry, particulate gravimetry -Properties of precipitates and precipitating reagents	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
2	4	Gravimetric analysis steps: sample preparation, precipitation, digestion, filtration, washing, drying or igniting, weighing and calculation.	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
3	4	Gravimetric calculations: gravimetric factor, analyte percentage	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
4	4	Practice Problems: gravimetric factor and analyte percentage	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
5	4	Precipitate reagents: organic precipitates, inorganic precipitates	Lectures, Laboratory classes	Quizzes, assessments, exams, reports

6	4	Mechanism of precipitation: -Theory of crystal formation -Colloidal precipitates versus crystalline precipitates	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
7	4	Impurities of precipitates: -Co-precipitation: true precipitation, occlusion, adsorption -Post precipitation	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
8	4	Solubility and solubility product: overview, formula, calculations	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
9	4	Factors affecting solubility: temperature, solute, solvent, common ion, pH, complex-ion formation, electrolyte concentration	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
10	4	Practice Problems: common ion, pH, complex-ion formation, electrolyte concentration	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
11	4	Statistics: errors in chemical analysis, tests of significance	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
12	4	Descriptive Statistics: Mean, median, mode, range, upper and lower quartiles, variance, and standard deviation	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
13	4	Hypothesis Testing : T-test, F-test, ANOVA	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
14	4	Review of key concepts	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
15	1	Midterm exam		

11.Course Evaluation
Theory (quizzes + assessments + activities + reports + exams) = 50% Laboratory classes = 10% Final exam = 40%

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	

Main references (sources)	1. Christian, G.D., Dasgupta, P.K. and Schug, K.A., 2013. Analytical chemistry. John Wiley & Sons. 2. Skoog, D.A., West, D.M., Holler, F.J. and Crouch, S.R., 2013. Fundamentals of analytical chemistry. 3. JAMES N MILLER, M.I.L.L.E.R., 2010. Statistics and Chemometrics for Analytical Chemistry
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

13.The most important sources of information about the program
Christian, G.D., Dasgupta, P.K. and Schug, K.A., 2013. Analytical chemistry. John Wiley & Sons.

14.Program Development Plan
Developing teaching methods such as group projects, case studies linked to the objectives of the module.

1. Course Name:
Inorganic Chemistry III
2. Course Code:
MU010302302
3. Semester / Year:
Semester I (2024-2025)
4. Description Preparation Date:
19/1/2025
5. Available Attendance Forms:
Weekly attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
120 hr (Lectures) + 30 hr (Laboratory classes)
7. Course administrator's name (mention all, if more than one name)
-Rehab A.M.J. Al-Hassani rehabalhassani@yahoo.com Hanaa.H .Hussein albajalanhanaa@yahoo.com

8. Course Objectives	
Course Objectives	**1. Understand the basic concepts of inorganic chemistry** **2. Learn about the periodic table** **3. Learn about the Periodic table areas** **4. Learn about the periodic table** **5. This course including the details about the visible light and Colours of Coordination Complexes:**

	6. Learn about Molecular Symmetry

9. Teaching and Learning Strategies	
Strategy	**Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.** **1. Recognize the basic information about the periodic table.** **2. List the rules we must follow her for showing the order in which electrons fill in around the nucleus** **3. Definition and explanation the Types of Hybridization** **4. A detailed explanation of the Chemistry of Hydrogen** **5. A detailed explanation of the Group 1 (Alkali Metal).** **6. The Group 2 Elements(The Alkaline Earths)Explain the acid-base theory for the solutions** **7. Explain the visible light.** **8. A detailed explanation of the Molecular Symmetry**

10. Course Structure

Week	Hours	Required Learning Outcomes	Learning method	Evaluation method
1	4	The periodic table	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
2	4	Periodic table areas	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
3	4	Electron Configurations	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
4	4	Periodic properties	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
5	4	The visible light	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
6	4	Wavelength and Color Spectrum	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
7	4	Colours of Coordination Complexes	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
8	4	Factors affecting colour	Lectures, Laboratory classes	Quizzes, assessments, exams, reports

9	4	Molecular Symmetry	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
10	4	exam	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
11	4	Hybridization: Definition of Hybridization and Types of Hybridization	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
12	4	The Chemistry of Hydrogen	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
13	4	Chemistry of the Alkali Metals	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
14	4	Chemistry of the Alkaline Earths Metals	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
15	1	Midterm exam		

11. Course Evaluation
Theory (quizzes + assessments + activities + reports + exams) = 50% Laboratory classes = 10% Final exam = 40%

12. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Main references (sources)	1. Inorganic Chemistry"by Gary l. Miessler, Donald A. Tarr(3rd ed ,2003) 2. Inorganic Chemistry principles of structure and reactivity 4th ed, by James E. Huhhey et al, Harper Collins college Puplishers (1993) 3. Shriver & Atkins' Inorganic Chemistry,by Atkins, Overton, Rourke Weller, Armstrong, 4th ed,Oxford (2006),
Recommended books and references (scientific journals, reports...)	1.General chemistry,Whitten, K. W., Davis, R. E., Peck M. L., and Stanley, G. G.,(2004).7th Ed. Thomson/Brooks/Cole.,. 2. Inorganic Chemistry, ,Prem Dhawan,2008
Electronic References, Websites	

13. The most important sources of information about the program
Inorganic Chemistry principles of structure and reactivity 4th ed, by James E. Huhhey et al, Harper Collins college Puplishers (1993)

14. Program Development Plan
Developing teaching methods such as group projects, case studies linked to the objectives of the module.

1.Course Name:
Thermodynamic chemistry
2.Course Code:
MU010302303
3.Semester / Year:
Semester I (2024-2025)
4.Description Preparation Date:
19/1/2025
5.Available Attendance Forms:
Weekly attendance
6.Number of Credit Hours (Total) / Number of Units (Total)
120hr (Lectures) + 30 hr (Laboratory classes)
7.Course administrator's name (mention all, if more than one name)
Asmaa Jameel Ali asas.jameil@uomustansiriyah.edu.iq

8.Course Objectives	
Course Objectives	**1. This course including discuss the mathematical viabilities and standard procedure required in effective study of physical chemistry.** **2. Explain the basic concepts of thermodynamics, Terms: System, surroundings etc. Types of systems ,intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.** **3. First Law of Thermodynamics. the zeroth and first law of thermodynamics, internal energy, the work and heat in process.** **4. Calculations of w, q, dU & ΔH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.** **5. Define Enthalpy and standard enthalpy changes, heat capacity, thermochemistry, properties of the state functions.** **6. Define The second law of thermodynamics, entropy.** **7. Entropy as a function of temperature and pressure ,Carnot cycle and Maxwell relation.** **8. The third law of thermodynamics, Helmholtz and Gibbs energy, the dependence of Gibbs energy on temperature and pressure.** **9.solve problems in thermodynamics and thermochemistry and their applications.**

10 .Teaching and Learning Strategies	
Strategy	**Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.** **1. List and explain the basic principles of thermodynamics and thermochemistry.** **2. Identify the thermodynamic systems and processes.** **3. Apply calculation in solving physical and chemical problems.** **4. Explain Hess's law of constant heat ,Gibbs energy and spontaneity.** **5. Explain third law of thermodynamic.** **6. calculation enthalpy of reaction from Hess's law .**

10.Course Structure

Week	Hours	Required Learning Outcomes	Learning method	Evaluation method
1	4	Introduction to gases, All laws of gases ,ideal gas equation, intermolecular forces-van Der waals gas equation.	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
2	4	Deviation from ideal behavior ,Graham's law of diffusion, Law of corresponding states,Examples.	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
3	4	Thermodynamic ,type of thermodynamic systems, extensive and intensive quantities ,kinds of functions, Zeroth and first law of thermodynamic.	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
4	4	Types of thermodynamic processes ,work, general expression of the expansion work, expantion against constant pressure, isothermal reversible expansion	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
5	4	Heat transaction, heat capacity , relation between heat capacity and temperature,relation between Cv and Cp	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
6	4	Adiabatic processes, relation between volume and T, v and p ,T and p in adiabatic processes, question and solution	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
7	4	Exam	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
8	4	Introduction in thermochemistry ,Hess law	Lectures, Laboratory classes	Quizzes, assessments, exams, reports

9	4	Standard enthalpy of formation ,heat of combustion	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
10	4	Heat of solution and heat of neutralization	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
11	4	Bond energies ,bond dissociation energy ,examples and solutions.	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
12	4	Second law of thermodynamic ,entropy ,changes in entropy in isothermal processes	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
13	4	Carnot cycle ,calculation of entropy changes in irreversible process,free energy	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
14	4	Maxwell relation ,third law of thermodynamics.	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
15	1	Exam		

11.Course Evaluation
Theory (quizzes + assessments + activities + reports + exams) = 50% Laboratory classes = 10% Final exam = 40%

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Main references (sources)	1-physical chemistry thermodynamic ,structure and change .10th edition by peter Atkins and Julio de paula .2014. 2-: physical chemistry thermodynamic ,structure and change .11th edition by peter Atkins and Julio de paula .2018.
Recommended books and references (scientific journals, reports...)	Physical Chemistry" by Peter Atkins , 10th Edition, 201
Electronic References, Websites	

13.The most important sources of information about the program
Physical Chemistry" by Peter Atkins , 10th Edition, 2014.

14.Program Development Plan
Developing teaching methods such as group projects, case studies linked to the objectives of the module.

1.Course Name:
Alphatic organic chemistry
2.Course Code:
MU010302304
3.Semester / Year:
Semester I (2024-2025)
4.Description Preparation Date:
19/1/2025
5.Available Attendance Forms:
Weekly attendance
6.Number of Credit Hours (Total) / Number of Units (Total)
145hr (Lectures) + 30 hr (Laboratory classes)
7.Course administrator's name (mention all, if more than one name)
Roaa Majid Abdul-Amir rmaah1984@uomustansiriyah.edu.iq

8.Course Objectives	
Course Objectives	**1. Understanding and applying concepts of an organic chemical structure and bonding and stability by predicting and explaining shape, structure, bonding, hybridization, stability, acidity, basicity, solubility, and reactivity for hydrocarbons, halocarbons, alkenes, dienes, and arenes.** **2. Recognize and Apply Functional Groups. Classify organic molecules by their functional groups, and identify fundamental properties associated with those functional groups.** **3. Prediction of reaction products: including stereochemistry, in the reactions of alkanes, halocarbons, alkenes, dienes, and arenes.** **4. Able to recognize, classify, explain, reaction mechanisms, and apply fundamental organic reactions such as SN2, SN1, E2, E1, alkene addition, electrophilic aromatic substitution, and ring-opening.** **5. Use retrosynthetic analysis to design efficient multi-step syntheses involving halocarbons, alkenes, and arenes as intermediates or final products.** **6. Predict and explain patterns in stability, shape, hybridization, reactivity, and product formation when resonance or conjugation applies to a reactant, intermediate, or final product.** **7. Provide correct IUPAC and common names for alkanes, halocarbons, alkenes, and aromatics, including cyclic molecules and stereochemistry.** **8. Explain the difference between a saturated and an unsaturated hydrocarbon.**

11 .Teaching and Learning Strategies	
Strategy	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 1. Identify and draw organic compounds. 2. Uses of some organic compounds. 3. Provide the IUPAC name for some organic compounds. 4. Classify carbon atom. 5. Recognize between aliphatic and aromatic compounds. 6. Identify and draw cyclic aliphatic compounds. 7. Explain the properties of arenes and epoxides. 8. Discuss the reactions of alicyclic compounds. 9. Write detailed mechanisms for various fundamental reactions of alkanes, halocarbons, alkenes, dienes, and arenes. 10. Identify the structure of benzene ring.

10.Course Structure				
Week	**Hours**	**Required Learning Outcomes**	**Learning method**	**Evaluation method**
1	4	fundamentals	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
2	4	alkanes (Structure, nomenclature, physical properties, and conformations)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
3	4	alkanes (preparation, reactions, mechanism, reactivity, selectivity, and analysis)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
4	4	Alkenes (Structure, nomenclature, and physical properties)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
5	4	Alkenes(geometric isomers, and preparation)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
6	4	alkenes (reactions, mechanism, and analysis)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
7	4	dienes	Lectures, Laboratory classes	Quizzes, assessments, exams, reports

8	4	alkynes (Structure, acidity, nomenclature, and physical properties), (first exam)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
9	4	alkynes (preparation, reactions, mechanism, and analysis)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
10	4	Cyclic aliphatic compounds	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
11	4	Cyclic aliphatic compounds , epoxides	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
12	4	Benzene (nomenclature, physical properties, stability, resonance, representation, Huckel rule, preparation, and reactions)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
13	4	benzene (mechanism, effect of a substituent group, orientation in disubstituted, theory of orientation, and analysis)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
14	4	Arenes	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
15	1	Naphthalene, (second exam)		

11.Course Evaluation
Theory (quizzes + assessments + activities + reports + exams) = 50% Laboratory classes = 10% Final exam = 40%

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Main references (sources)	R.T. Morrison and R.N. Boyd, organic chemistry, 6th Edition, Prentice-Hall.
Recommended books and references (scientific journals, reports...)	اسس الكيمياء العضوي, تاليف أ.د. يوسف علي الفتاحي, 1989
Electronic References, Websites	

13.The most important sources of information about the program

14.Program Development Plan

Developing teaching methods such as group projects, case studies linked to the objectives of the module.

1.Course Name:
Computers
2.Course Code:
MU 14
3.Semester / Year:
Semester I (2024-2025)
4.Description Preparation Date:
19/1/2025
5.Available Attendance Forms:
Weekly attendance
6.Number of Credit Hours (Total) / Number of Units (Total)
50 hr (Lectures)
7.Course administrator's name (mention all, if more than one name)
Esraa Jaffar Baker es-alshaibany@uomustansiriyah.edu.iq .

8.Course Objectives	
Course Objectives	**1. Understand spreadsheet software (MS Excel 2016) interface.** **2. To learn and work on MS Excel and process Chemical data sets by using MS Excel.** **3. Work on the ChemDraw interface and its tools.** **4. Learn to create chemical structures using the tools of ChemDraw.** **5. Learn to convert a chemical structure into a name and convert a name into a structure.**

9 .Teaching and Learning Strategies	
Strategy	1. Students will have knowledge of how to use the MS Excel interface. 2. Students will have a working knowledge of basic functions and formulas in MS Excel . 3. Students can use charts and tables to analyze chemical data sets. 4. Students will have knowledge of the ChemDraw interface. 5. Students will be able to use ChemDraw tools to create chemical structures. 6. Students can convert chemical structure to name and name to structure.

10.Course Structure

Week	Hours	Required Learning Outcomes	Learning method	Evaluation method
1	2	**Microsoft Office Excel (2016)** Introduction to Excel interface: The Ribbon, The Quick Access Toolbar,	Lectures, Laboratory classes	Questions and discussion

		Columns and Rows, Entering Text, Moving Text and Numbers, Insert a Row or Column, Delete a Row or Column, Changing Column Width and Row Height, Formatting Text and Numbers, Changing the Font.		
2	2	Microsoft Office Excel(2016) Range: Using Ranges, Selecting a Range, Naming a Range, Copy and Paste a Range.	Lectures, Laboratory classes	Questions and discussion
3	2	**Microsoft Office Excel (2016)** Formatting: Formatting as a Table, Conditional Formatting.	Lectures, Laboratory classes	Questions and discussion
4	2	**Microsoft Office Excel (2016)** Sorting: Sorting with the Sort & Filter Button, Sorting with the Data Sort Menu.	Lectures, Laboratory classes	Questions and discussion
5	2	(2016) Microsoft Office Excel Formulas: Basic Information, Entering a Formula, Editing a Formula.	Lectures, Laboratory classes	Questions and discussion
6	2	(2016) Microsoft Office Excel Functions: Understand functions, Use basic functions, Insert Function Button, Know the difference between formulas and functions, Auto Calculate, AutoSum.	Lectures, Laboratory classes	Questions and discussion
7	2	Mid-term Exam	Lectures, Laboratory classes	Questions and discussion
8	2	(2016) Microsoft Office Excel Charts: Inserting a Chart, Learn the most commonly used Charts, Chart Elements, Chart Styles, Using Chart Filters, Switching Row and Column Data, Changing the Chart Type.	Lectures, Laboratory classes	Questions and discussion
9	2	(2016) Microsoft Office Excel Analyzing Chemical Data Using .PivotTables and Pivot Charts	Lectures, Laboratory classes	Questions and discussion
10	2	ChemOffice (ChemDraw) Introduction to chemoffice and ChemBioDraw, understanding ChemDraw User Interface, ChemDraw Toolbars, Docking and Floating, Using Documents.	Lectures, Laboratory classes	Questions and discussion

11	2	ChemDraw Basic Drawings, Bonds, Drawing bonds, Bond Types.	Lectures, Laboratory classes	Questions and discussion
12	2	ChemDraw Captions and Atom labels.	Lectures, Laboratory classes	Questions and discussion
13	2	ChemDraw Rings Drawings rings, Spiro and Sprout Rings, Arrows, and Shapes.	Lectures, Laboratory classes	Questions and discussion
14	2	ChemDraw Check Structure, Converting Names to Structures, Converting Structures to Name, Drawing Structures.	Lectures, Laboratory classes	Questions and discussion
15	1	EXAM		

11.Course Evaluation
Theory (quizzes + assessments + activities + reports + exams) = 50% Final exam = 50%

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Main references (sources)	**1-** Joan Lambert and Curtis Frye, Microsoft Office 2016 Step by Step, 1st Edition, 2016. PerkinElmer Informatics, ChemDraw 15.0 User Guide, Inc. All Rights Reserved, 2015.
Recommended books and references (scientific journals, reports...)	ChemDraw for Windows and Macintosh, ChemDraw User's Manual – CambridgeSoft, 2004.
Electronic References, Websites	

13.The most important sources of information about the program
2- Joan Lambert and Curtis Frye, Microsoft Office 2016 Step by Step, 1st Edition, 2016

14.Program Development Plan
Developing teaching methods such as group projects, case studies linked to the objectives of the module.

1.Course Name:
Seperation methods
2.Course Code:
MU010302401
3.Semester / Year:
Semester I (2024-2025)
4.Description Preparation Date:
19/1/2025
5.Available Attendance Forms:
Weekly attendance
6.Number of Credit Hours (Total) / Number of Units (Total)
120hr (Lectures) + 30 hr (Laboratory classes)
7.Course administrator's name (mention all, if more than one name)
Raghad Al-Salhi alsalhi.r@uomustansiriyah.edu.iq

8.Course Objectives	
Course Objectives	**1 .Understand the fundamental principles of analytical separation techniques including mechanisms of separation, sample types… etc.** **2 .Learn about the various components/parts of each separation system** **3 .Understand sample preparation techniques that are compatible with each technique** **4 .Explore the various applications of each technique** **5 .Perform calculations to choose the appropriate separation conditions** **6 .Explore the advantages and limitations of each separation method** **7. Learn how to choose a suitable technique based on factors such as the analytes of interest, the nature of the sample matrix… etc.**

9 .Teaching and Learning Strategies	
Strategy	.Understand the fundamental principles that govern separation processes, such as saturation, solubility, partitioning, adsorption… etc 2 .Learn how to qualitatively identify the presence of specific components and/or quantitatively recover analytes of interest from samples 3 .Learn how to choose appropriate factors like polarity, boiling points, appropriate precipitating agents, extracting solvents… etc 4 .Learn how to adjust parameters like charge and size of the analytes, pH, mobile phase composition, ionic strength to achieve desired separations 5 .Evaluate the efficiency of the separation technique using its related calculations 6. Select the right separation method based on availability of the equipment and

	resources, required time, sensitivity and detection.

10.Course Structure				
Week	**Hours**	**Required Learning Outcomes**	**Learning method**	**Evaluation method**
1	4	Introduction to Analytical Separation :Methods Classification of separation - techniques: Chromatographic, electrophoresis, Precipitation, Extraction, Distillation Principles of separation - -Applications	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
2	4	Ion exchange chromatography+exam	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
3	4	Paper Chromatography, Thin-Layer Chromatography	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
4	4	Liquid Chromatography, Gas Chromatography	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
5	4	Supercritical Fluid Chromatography, Gel Electrophoresis +exam	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
6	4	Chromatography calculations: Retention Factor (Rf), Capacity Factor (k)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
7	4	Chromatography calculations: Resolution (Rs), Plate Number (N), Efficiency (H)+exam	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
8	4	Precipitation Techniques: Based on acidity control, Sulfide separation, inorganic and organic precipitants	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
9	4	Precipitation Techniques: Trace amount precipitation, electrolytic precipitation, salt-induced precipitation of proteins	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
10	4	Distillation Techniques: Simple and Fractional distillation+exam	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
11	4	Distillation Techniques: Vacuum, Molecular and Steam distillation	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
12	4	Extraction Techniques: formulae, types, factors affecting extraction methods and applications	Lectures, Laboratory classes	Quizzes, assessments, exams, reports

13	4	Liquid-Liquid extraction, Solid-phase extraction +exam	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
14	4	Review of key concepts	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
15	1	Midterm exam		

11.Course Evaluation
Theory (quizzes + assessments + activities + reports + exams) = 50% Laboratory classes = 10% Final exam = 40%

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Main references (sources)	Meloan CE. Chemical separations: Principles, techniques, and experiments. Wiley; 1999.
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

13.Program Development Plan
Developing teaching methods such as group projects, case studies linked to the objectives of the module.

1.Course Name:
Inorganic elements Chemistry
2.Course Code:
MU010302402
3.Semester / Year:
Semester I (2024-2025)
4.Description Preparation Date:
19/1/2025
5.Available Attendance Forms:
Weekly attendance
6.Number of Credit Hours (Total) / Number of Units (Total)
120hr (Lectures) + 30 hr (Laboratory classes)
7.Course administrator's name (mention all, if more than one name)
Rehab A.M.J. Al-Hassani rehabalhassani@yahoo.com

8.Course Objectives	
Course Objectives	**1. A detailed explanation of the third group** **2. A detailed explanation of the fourth group** **3. A detailed explanation of the fifth group** **4. A detailed explanation of the Sixth group:**

	5. A detailed explanation of the seventh group **6. A detailed explanation of the solid state and The structure of complex solids** **7. X-ray diffraction, Crystals containing infinite three dimensional complexes and Application of x-ray diffraction** **.8 Theories of acid and base and Oxygen acids** **9. Classification of solvents**

9 .Teaching and Learning Strategies	
Strategy	1. Recognize the basic information about the third group,The fourth group, the fifth group , Sixth group and the seventh group 2. A detailed explanation of the solid state 3. A detailed explanation of the structure of complex solids 4. A detailed explanation of the X-ray diffraction, Crystals containing infinite three dimensional complexes 5. A detailed explanation of the x-ray diffraction 6. A detailed explanation of the Theories of acid and base and Oxygen acids 7. Classification of solvents

10.Course Structure

Week	Hours	Required Learning Outcomes	Learning method	Evaluation method
1	4	The third group	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
2	4	The fourth group	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
3	4	The fifth group	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
4	4	Sixth group	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
5	4	The seventh group	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
6	4	Exam	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
7	4	The solid state	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
8	4	The structure of complex solids	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
9	4	X-ray diffraction	Lectures, Laboratory classes	Quizzes, assessments, exams, reports

10	4	Crystals containing infinite three dimensional complexes	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
11	4	Application of x-ray diffraction	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
12	4	Theories of acid and base	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
13	4	Oxygen acids	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
14	4	Classification of solvents	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
15	1	Exam		

11.Course Evaluation
Theory (quizzes + assessments + activities + reports + exams) = 50% Laboratory classes = 10% Final exam = 40%

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Main references (sources)	1 .Inorganic Chemistry"by Gary l. Miessler, Donald A. Tarr(3rd ed ,2003) 2 .Inorganic Chemistry principles of structure and reactivity 4th ed, by James E. Huhhey et al, Harper Collins college Puplishers (1993) 3. Shriver & Atkins' Inorganic Chemistry,by Atkins, Overton, Rourke Weller, Armstrong, 4th ed,Oxford (2006),
Recommended books and references (scientific journals, reports...)	1- General chemistry,Whitten, K. W., Davis, R. E., Peck M. L., and Stanley, G. G.,(2004).7th Ed. Thomson/Brooks/Cole.,. 2. Inorganic Chemistry, ,Prem Dhawan,2008
Electronic References, Websites	

13.The most important sources of information about the program
.Inorganic Chemistry principles of structure and reactivity 4th ed, by James E. Huhhey et al, Harper Collins college Puplishers (1993)

14.Program Development Plan
Developing teaching methods such as group projects, case studies linked to the objectives of the module.

1.Course Name:
Thermodynamic of liquids
2.Course Code:
MU010302403
3.Semester / Year:
Semester I (2024-2025)
4.Description Preparation Date:
19/1/2025
5.Available Attendance Forms:
Weekly attendance
6.Number of Credit Hours (Total) / Number of Units (Total)
145hr (Lectures) + 30 hr (Laboratory classes)
7.Course administrator's name (mention all, if more than one name)
Asmaa Jameel Ali asas.jameil@uomustansiriyah.edu.iq

8.Course Objectives	
Course Objectives	**1. This course including the details about the phase equilibrium , the phase rule ,phase, number of components ,degrees of freedom.** **2. Phase diagram for one and two component.** **3. Clapeyron equation ,the Clausius –Clapeyron equation .,Troton's rule.** **4. Soultion and type of solutions .,Raoult's law ,deviation from raoult's law** **5. Define Azotropic mixture ,partially miscible and immisicible liquids.** **6. Colligative properties of solutions.** **7. Define chemical equilibrium ,the law of mass action** **8. Determination of equilibrium constant for gas reactions** **9. Dissociation of gases from density ,chemical equilibrium for heterogenous reaction** **10.solve problems in solution ,phase equilibrium and chemical equilibrium.**

9 .Teaching and Learning Strategies	
Strategy	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 1 .List and explain the basic principles of phase equilibrium and solution. .2 Identify the phase rule and phase diagram for one and Two systems . .3 Apply calculation in solving physical and chemical problems. 4.characteristics of equilibrium constant. 5. Explain colligative properties of solutions .

10.Course Structure

Week	Hours	Required Learning Outcomes	Learning method	Evaluation method
1	4	**Phase equilibrium** (The phase rule, number of component ,degrees of	Lectures, Laboratory classes	Quizzes, assessments, exams, reports

		freedom , the phase diagram , phase diagram of one component system.		
2	4	Phase diagram for Two component system ,solid –liquid system, liquid-liquid system, solid-solid system.	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
3	4	Clapeyron equation ,Clausius – clapeyron equation, Trouton's Rule ,Examples .	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
4	4	**Solutions** (The components of the solution, type of solutions, ,ideal solution , Raoult's law ,deviation from Raoult's law ,Azotropic mixture.	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
5	4	The real solution ,vapour pressure-composition diagram for ideal solution composition of liquid and vapour , Azotropic mixture boiling point composition diagrams for ideal liquid .	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
6	4	Boiling point elevation of solutions, Freezing point depression of solutions and osmotic pressure	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
7	4	Problems and solution	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
8	4	Exam 1	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
9	4	**Chemical equilibrium** (The law of mass action , relation between K_X,K_p,K_c,, characteristics of equilibrium constant , relation between ΔG and equilibrium constant .	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
10	4	determination of equilibrium constant for gas reactions , determination of equilibrium constant in homogenous liquid system	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
11	4	dissociation of gases from density ,effect of Temperature on chemical equilibrium ,chemical equilibrium for hetero genous reaction).	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
12	4	Calculation of chemical equilibrium by indirect method	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
13	4	Quantitive relation between free energy and equilibrium constant .	Lectures, Laboratory classes	Quizzes, assessments, exams, reports

14	4	Problems and solutions	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
15	1	Exam 2		

11.Course Evaluation
Theory (quizzes + assessments + activities + reports + exams) = 50% Laboratory classes = 10% Final exam = 40%

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Main references (sources)	Physical Chemistry" by Peter Atkins , 11th Edition, 2018.
Recommended books and references (scientific journals, reports...)	Physical Chemistry" by Peter Atkins , 10th Edition, 2014.
Electronic References, Websites	

13.The most important sources of information about the program
. Physical Chemistry" by Peter Atkins , 11th Edition, 2018.

14.Program Development Plan
Developing teaching methods such as group projects, case studies linked to the objectives of the module.

1.Course Name:
Aromatic organic chemistry
2.Course Code:
MU010302404
3.Semester / Year:
Semester I (2024-2025)
4.Description Preparation Date:
19/1/2025
5.Available Attendance Forms:
Weekly attendance
6.Number of Credit Hours (Total) / Number of Units (Total)
145hr (Lectures) + 30 hr (Laboratory classes)
7.Course administrator's name (mention all, if more than one name)
Roaa Majid Abdul-Amir rmaah1984@uomustansiriyah.edu.iq

8.Course Objectives	
Course Objectives	

	1. Understanding and applying concepts of an organic chemical structure and bonding and stability by predicting and explaining shape, structure, bonding, hybridization, stability, acidity, basicity, solubility, and reactivity for aromatic, alkyl halides, alcohol, aryl benzene, ketones, and aldehydes. **2. Recognize and Apply Functional Groups. Classify organic molecules by their functional groups, and identify fundamental properties associated with those functional groups.** **3. Prediction of reaction products: including stereochemistry, in the reactions of alkyl halides, alcohol, aryl benzene, ketones, and aldehydes.** **4. Able to recognize, classify, explain, reaction mechanisms, and apply fundamental organic reactions such as SN2, SN1, E2, E1, alkene addition, electrophilic aromatic substitution, and ring-opening.** **5. Use retrosynthetic analysis to design efficient multi-step syntheses involving halocarbons, alkenes, and alkyl halides as intermediates or final products.** **6. Predict and explain patterns in stability, shape, hybridization, reactivity, and product formation when resonance or conjugation applies to a reactant, intermediate, or final product.** **7. Provide correct IUPAC and common names for alkyl halides, alcohol, aryl benzene, ketones, and aldehydes.** **8. Explain the difference between a saturated and an unsaturated hydrocarbon.**

9 .Teaching and Learning Strategies	
Strategy	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 1. Identify and draw alkyl halides, alcohol, aryl benzene, ketones, and aldehydes. 2. Uses of some ketones, and aldehydes. 3. Provide the IUPAC name for some alkyl halides, alcohol, aryl benzene, ketones, and aldehydes. 4. Classify alcohols and alkyl halides. 5. Identify aldehydes and ketones. 6. Recognize between aldehydes and ketones. 7. Explain the properties of alcohols and ethers. 8. Discuss the reactions of alcohols and ethers. 9. Write detailed mechanisms for various fundamental reactions of alkyl halides, alcohol, aryl benzene, ketones, and aldehydes. 10. Identify the structure of alkyl benzene ring.

10.Course Structure

Week	Hours	Required Learning Outcomes	Learning method	Evaluation method
1	4	Fundamentals of aromatic- aliphatic compounds	Lectures, Laboratory classes	Quizzes, assessments, exams, reports

2	4	Alkyl benzene	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
3	4	Alkenyl benzenes	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
4	4	Alkyl halides (Structure, nomenclature, physical properties, and classification)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
5	4	Alkyl halides (preparation, reactions, mechanism, and analysis)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
6	4	Alcohols	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
7	4	Alcohols and ethers	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
8	4	Ethers	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
9	4	(Frist exam)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
10	4	Aldehydes (structure, nomenclature, and physical properties)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
11	4	Aldehydes (preparation, reactions, mechanism, and analysis)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
12	4	Ketones (structure, nomenclature, and physical properties)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
13	4	Ketones (preparation, reactions, mechanism, and analysis)	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
14	4	Nucleophilic addition, cannizzaro reaction, aldol reaction, wittig reaction	Lectures, Laboratory classes	Quizzes, assessments, exams, reports
15	1	(second exam)		

11.Course Evaluation
Theory (quizzes + assessments + activities + reports + exams) = 50% Laboratory classes = 10% Final exam = 40%

12.Learning and Teaching Resources	
Required textbooks	

(curricular books, if any)	
Main references (sources)	R.T. Morrison and R.N. Boyd, organic chemistry, 6th Edition, Prentice-Hall.
Recommended books and references (scientific journals, reports...)	اسس الكيمياء العضوي, تاليف أ.د. يوسف علي الفتاحي, 1989
Electronic References, Websites	https://www.noor-book.com/book/review/303958

13.The most important sources of information about the program
R.T. Morrison and R.N. Boyd, organic chemistry, 6th Edition, Prentice-Hall.

14.Program Development Plan
Developing teaching methods such as group projects, case studies linked to the objectives of the module.