Al al-Bayt University

Faculty of Science

Study Plan for

Master Degree

In

Department of Chemistry

(Thesis Track)

July/RB

Department of Chemistry
Faculty of Science
Al al-Bayt University

Master degree in Chemistry

Study Plan 2022/2023 (Thesis Track)
Degree name: M. Sc. in Chemistry

A. General terms and Conditions

1. **This plan adheres to the instructions for granting a master's degree at Al al-Bayt University.**
2. **The qualification accepted in this program: Bachelor's degree in Chemistry.**

B. Plan Framework:

The Study Plan for the Master degree in Chemistry (Thesis Track) consists of (33) thirty-three credit hours distributed as follows:

Serial	Requirement type	Course Credit Hours
Firstly	Specialization Requirements: a. Obligatory Courses b. Elective Courses c. Master Thesis	 15 9 9
Total		33

C. Numbering system:

1. **Code Faculty**

Code	Faculty
04	Science

2. **Code Department**

Code	Department
03	Chemistry

3. **Courses code**

04	01	7	2	1
↑	↑	↑	↑	↑
Faculty	Department	Level	Field	Serial

The meaning of the tens place (the range) in the subject numbers

Domain code	Title of the field of specialization	Domain code	Title of the field of specialization
0	General chemistry	5	Special topics in chemistry
1	Organic chemistry	6	
2	Inorganic chemistry	7	
3	Analytical chemistry	8	
4	Physical chemistry	9	

D) Preparatory Courses: Determined according to the instructions for graduate studies at Al al-Bayt University.
E) Major Requirements: (33) hours distributed as follows:
A- Obligatory Courses: (15) credit hours.
B- Elective Courses: (9) credit hours.
C- Master's Thesis: (9) credit hours.

A. Obligatory Courses (15) credit hours distributed among the following courses:

Serial	Course No.	Course Title	Credit hours	Type of learning
1	0403701	Scientific research methods in chemistry	3	Face to face
2	0403711	Advanced organic chemistry (1)	3	Face to face
3	0403721	Chemical applications of group theory	3	Face to face
4	0403731	Advanced analytical chemistry	3	Face to face
5	0403741	Advanced physical chemistry	3	Face to face
Total			**15**	

B. Elective Courses: (9) credit hours to be selected from the following courses:

Serial	Course No.	Course Title	Credit hours	Type of learning
1	0403713	Chemistry of natural products	3	Blended
2	0403712	Advanced organic chemistry (2)	3	Blended
3	0403726	Inorganic synthesis and reactivity	3	Blended
4	0403722	Advanced transition metal chemistry	3	Blended
5	0403732	Analytical environmental chemistry	3	Blended
6	0403734	Modern separation methods	3	Blended
7	0403742	Kinetics of chemical reactions	3	Blended
8	0403743	Statistical thermodynamics	3	Blended
9	0403745	Polymer science and technology	3	Blended
10	0403751	Special topics in chemistry	3	Face to face

C. A thesis (0403799): (9) credit hours.

Courses offered by the department

Serial	Course No.	Course Title	Credit hours	Type of learning
1	0403701	Scientific research methods in chemistry	3	Face to face
2	0403711	Advanced organic chemistry (1)	3	Face to face
3	0403712	Advanced organic chemistry (2)	3	Blended
4	0403713	Chemistry of natural products	3	Blended
5	0403721	Chemical applications of group theory	3	Face to face
6	0403726	Inorganic synthesis and reactivity	3	Blended
7	0403722	Advanced transition metal chemistry	3	blended
8	0403731	Advanced analytical chemistry	3	Face to face

9	0403732	Analytical environmental chemistry	3	Blended
10	0403734	Modern separation methods	3	Blended
11	0403741	Advanced physical chemistry	3	Face to face
12	0403742	Kinetics of chemical reactions	3	Blended
13	0403743	Statistical thermodynamics	3	Blended
14	0403745	Polymer science and technology	3	Blended
15	0403751	Special topics in chemistry	3	Face to face

Master thesis numbers

Serial	Course No.	Course Title	Credit hours	Type of learning
1	0403799	Master Thesis	9	blended
2	9010797	Master Thesis	3	Online
3	9010798	Master Thesis	6	blended

Summary of Learning Types in the Study Program for a Master of Mathematics Program (Thesis Track)

Type of learning	Online	Blended	face-to-face	Total
Number of credit hours	3	12	18	33
Percent	10%	36%	54%	100%

Courses Description

Course No.	Scientific research methods in chemistry	(3) credit hours	Type of learning
0403701		pre-requisite: None	Face to face
This course aims to improve the ability of graduate students in research and covers the following topics: research and analyze the chemical literature, research in chemical database, analyze of research articles and reports, writing scientific articles and reports, preparation of power point presentation, thesis writing. Prepare and present a model of a research article on new chemistry topic.			

Course No.	Advanced organic chemistry (1)	(3) credit hours	Type of learning
0403711		pre-requisite: None	Face to face
This course aims to provide the students an advanced knowledge about the following topics: description of molecular structure using valence bond concepts and molecular orbital theory, stereochemistry, conformation, and stereo selectivity, structural effects on stability and reactivity, organic reactions mechanisms: nucleophilic substitution, polar addition and elimination reactions, carbanions and other carbon nucleophiles, addition, condensation and substitution reactions of carbonyl compounds, aromaticity, concerted pericyclic reactions, photochemical reactions.			

Course No.	Advanced organic chemistry (2)	(3) credit hours	Type of learning
0403712		pre-requisite: None	Blended
Study of electrophilic and nucleophilic substitution reactions in aliphatic and aromatic systems, elimination and addition reactions to carbon - carbon multiple bonds, addition reactions to carbon-oxygen-double bonds (carbonyl groups), rearrangement reactions, study of the reactions of the sigmatropic rearrangements, study of oxidation reduction reactions (including the mechanisms, reactivity and orientation).			
Course No.	Chemistry of natural products	(3) credit hours	Type of learning
0403713		pre-requisite: None	Blended
This course aims to show students how nature contributes to contemporary medicine. This course provides students with a basic understanding and knowledge of the chemistry of natural products of medicinal importance. The following topics will be included during the study of this course: primary and secondary metabolism the building blocks, the construction mechanisms, the acetate pathway: fatty acids and polyketides, the shikimate pathway: aromatic amino acids and phenylpropanoids, the mevalonate and methylerythritol phosphate pathways: terpenoids and steroids, alkaloids, peptides, proteins. Carbohydrates, flavonoids.			

Course No.	Chemical applications of group theory	(3) credit hours	Type of learning
0403721		pre-requisite: None	Face to face
The course starts with definitions and properties of groups, subgroups, classes and cyclic groups. Once this is covered the course will deal with symmetry elements and point groups, direct product of symmetry elements and multiplication tables of a variety of groups, mullikan symbols with different notations, combination of symmetry considerations and hybridization schemes for σ- type orbitals in different molecules. Next, the subject of projection operator will be covered and also the application of this concept to symmetry adapted linear combination of atomic orbitals (salcao-concept). Both σ and pi orbital combination will be covered employing the projection operator concept. The course will deal with normal modes of vibrations by using symmetry considerations to determine which of these modes are ir-active, raman-active or both. The last part of this course will cover ligand field theory, russell-saunders term symbols and microstates. Finally, the principles and selection rules in vibrational and electronic transition spectroscopies will be discussed in details.			

Course No.	Advanced Transition Metal Chemistry	(3) credit hours	Type of learning
0403722		pre-requisite: None	blended
This is an advanced graduate level course that covers in detail the field of organometallic chemistry. Electron counting, metal-carbon bonding and ligands will be discussed in detail. Characterization of organometallic compounds by NMR and IR with special emphasis on multi-nuclear and variable temperature NMR. Reaction mechanisms and application of organometallic compounds as homogeneous catalysts will be considered. Application of organometallic to organic synthesis. Reading and understanding organometallic literatures are main aims of the course.			

Course No.	Inorganic synthesis and reactivity	(3) credit hours	Type of learning
0403726		pre-requisite: None	Blended
This course is focused on the reactions and reactivity of inorganic compounds. And also on the applications of synthesis inorganic complexes and organometallic complexes. Discussion of main concepts of reactivity of inorganic complexes will be discussed. Detailed synthesis examples of some complexes from simple starting material will be also covered.			

Course No.	Advanced analytical chemistry	(3) credit hours	Type of learning
0403731		pre-requisite: None	Face to face
The course covers the principles and applications of selected and advanced level in modern analytical chemistry methods including separation techniques, gc, hplc, electrophoresis, electrochemistry, spectroscopy and selected topics of unusual current interest. Applications of specialized techniques in the solving of analytical problems of current interest. Advanced topics in chemical equilibrium, and kinetics in analytical chemistry. Topics to cover include: errors in measurement, bi- and multi- variant data analysis, analysis of variance			

Course No.	Analytical environmental chemistry	(3) credit hours	Type of learning
0403732		pre-requisite: None	Blended
The course is designed to introduce students to the study of topics in environmental chemistry. Currently there are three modules available: (1) hazardous wastes and contaminated sites (2) atmospheric chemistry (3) introduction to environmental sites. This can by the studying of the natural and unnatural chemical substances in the environment, with particular emphasis on the problem of chemical pollution abatement. Topics include air pollution; water pollution and chemistry of the soil the importance of this course comes from the studying of the application for the analysis of the pollutants and the environmentally important compounds by spectroscopic methods (including error analysis). Spectrophotometer ftir, light scattering, fluorescence, phosphorescence, atomic absorption chromatographic methods (gc, gc/ms, hplc…), electroanalytical methods, and thermal methods.			

Course No.	Modern separation methods	(3) credit hours	Type of learning
0403734		pre-requisite: None	Blended
Chromatography of gll, gsc, llc, lsc, etc. The efficiency of separation, the blocks diagram of the chromatography instruments, all advanced types of chromatography. Explain the separation processes involved in molecular exclusion, affinity chromatography, ion and ion-exchange chromatography and capillary electrophoresis			

Course No.	Advanced physical chemistry	(3) credit hours	Type of learning
0403741		pre-requisite: None	Face to face

This course covers basic and advance concept of quantum mechanics: mathematical tools of quantum chemistry. Basic concept of quantum mechanics the postulates of quantum mechanics: (particle in a box, vibrational harmonic oscillator, angular and spin momentum and hydrogen like atom). Approximation method: perturbation theory and the variation method. Molecular electronic atom. Diatomic molecules huckel theory. This course also covers the time-dependent quantum mechanics, spectroscopy, and relaxation, with an emphasis on descriptions applicable to condensed phase problems and a statistical description of ensembles.

Course No.	Kinetics of chemical reactions	(3) credit hours	Type of learning
0403742		pre-requisite: None	Blended

This course deals with the experimental and theoretical aspects of chemical reaction kinetics, including transition-state theories, molecular theory, classical and modern techniques, quantum and statistical mechanical estimation of rate constants, pressure-dependence and chemical activation, complex reacting mixtures, consecutive elementary reactions. Molecular reaction dynamics. The characteristics of electronic transitions and general description of molecular spectroscopy. Fundamental and kinetics of photochemical reaction.

Course No.	Statistical thermodynamics	(3) credit hours	Type of learning
0403743		pre-requisite: None	Blended

Introduction, boltzmann-fermid-dirac and bose-einstein statistics; classical statistical thermodynamics; partition functions: ideal diatomic molecules, chemical equilibrium. Virial expansions; the debye-hückel theory for electrolytes; lattice models for liquids; the bragg-williams approximation. Partition functions: real gases

Course No.	Polymer science and technology	(3) credit hours	Type of learning
0403745		pre-requisite: None	Blended

Science of large molecules, classifications of polymers, polymer structure, degree of polymerization, polymerization process, polymerization mechanisms, IUPAC vs common polymer nomenclature, industrial polymers and their applications, polymer molecular weights, physical properties of polymers, chemical structure and morphology of polymers, viscoelasticity, shear flow, factors affecting glass transition, crystallinity, crosslinking , polymer blends, polymer fabrication methods, mechanical properties, stress-strain behavior.

Course No.	Special topics in chemistry	(3) credit hours	Type of learning
0403751		pre-requisite: None	Face to face

The department council decides the course content in a timely manner.

Course No.	Master thesis	(3) credit hours	Type of learning
0403799		pre-requisite: None	Blended

Student must have the department approval for the proposal, after successfully passing 15 credit hours.