

# Faculty of Science

## Department of Chemistry

### Study Plan for the Bachelor Degree in Chemistry

**2019 / 2020**

## **Vision:**

Excellence in learning and teaching chemistry, scientific research and community service.

## **Mission:**

Graduating students who are skilled and scientifically qualified in the field of chemistry by providing a stimulating educational and research environment to meet the labor market requirements.

## **Program Objectives:**

1. Preparing graduates who are able to employ their practical and scientific capabilities to meet the needs of the labor market.
2. Developing students' skills in scientific thinking and problem solving in the field of chemistry and its applications.
3. Developing students' criticism and scientific research skills.
4. Encourage scientific research for faculty members in the field of chemistry.
5. Activating community service through volunteer programs conducted by students and faculty members.
6. Establishing the concept of professional ethics for students and working with them.

## **\* Intended Learning Outcomes (ILOs):**

### **Student will be able to:**

1. An ability to acquire and apply new knowledge as required across different fields of chemistry, using appropriate learning strategies.
2. An ability to identify, formulate, and solve problems by applying principles and theories of chemistry, science and mathematics based on critical thinking.
3. An ability to develop and conduct appropriate experimentation, analyze, interpret data, and draw conclusions.
4. An ability to apply scientific principles and theories of chemistry to serve community in health, economic and environmental sectors.
5. An ability to communicate effectively with a wide range of audiences
6. An ability to recognize ethical and professional responsibilities in the field of chemistry, and make informed judgments that consider the impact of chemistry in global, economic, environmental and societal contexts.
7. An ability to function effectively as a part of a team, take on leadership positions, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives  
Demonstrate safety laboratory techniques.

**\* The Intended Learning Outcomes was changed according to dean council decision number (2021/2022/-30-20); 30/5/2022**

## Framework for Chemistry Bachelor Degree (135 Cr. Hrs.)

Classification	Credit Hours			Percentage
	Compulsory	Elective	Total	
University Requirements	12	12	24	18 %
Faculty Requirements	21	0	21	16 %
Program Requirements	75	12	87	64 %
Support Courses	0	0	0	0.0 %
Free Electives	0	3	3	2.0 %
<b>Total</b>	<b>120</b>	<b>90</b>	<b>135</b>	<b>100 %</b>

### Course Numbering: Example (General chemistry 1)

1	1	0	1	1	1	0	1
Faculty Code		Dept. Code		Course Level		Knowledge Field	Sequence

### Knowledge Areas

Number	Knowledge Field	Cr. Hr.
0	General chemistry	8
1	Organic chemistry and biochemistry	14
2	Inorganic chemistry	12
3	Analytical Chemistry	14
4	Physical Chemistry	13
5	Industrial and applied chemistry	6
6	Computational chemistry	3
7	More than one field in chemistry	6
8	General science	25
9	Training/graduation project/ Research paper and seminar	4

## 1. University Requirements: (24 Credit Hours)

### 1.1. Compulsory University Requirements: (12 Credit Hours)

Course No.	Course Title	Cr. Hr.	Prerequisite	Co-requisite
01101101	Military Sciences	3	Jordanian student*	
01101102	Arabic Language	3	Jordanian student*	
01101111	English Language	3	01100011**	
01101112	National Education	3	01100012**	
	<b>Total</b>	<b>12</b>		

\*Non-Jordanian student has the right to register it or choose one of the courses offered by the university.

\*\* If the student does not pass the level exams should be take the following courses:

Remedial Arabic language (01100011), Remedial English language (01100012), Remedial computer skills (0110005)

### 1.2. Elective: 12 Credit Hours from the following courses.

Course No.	Course Title	Cr. Hr.	Prerequisite
01101103	Traffic Education	3	
01101104	Innovation and Entrepreneurship	3	
01101121	Life Skills	3	
01101131	Islamic Education	3	
01101132	Jerusalem and the Hashemite custodianship	3	
01101141	Sports and Health	3	
01101142	Environment and Society	3	
01101151	Computer Skills	3	01100051 Pre
01101152	Internet and communication	3	
01101161	Economics System and Concepts		
01101171	Psychology and Society	3	
01101172	Modern language	3	
01101213	Communication Skills in Arabic	3	01101111 Pre
01101214	Communication Skills in English	3	01101112 Pre
01101243	Safety and First Aid	3	
01101281	Scientific Research Methods	3	
01101282	Introduction to Astronomy	3	
03011101	Law in Our Life	3	
03021201	Human Rights	3	

## 2. Faculty Requirements: (21Credit Hours)

### 2.1Compulsory Faculty Requirements: (21 Credit Hours)

Course No.	Course Title	Cr. hr.	Theory	Prerequisite
06051211	Programming Fundamentals	3	3	01100051 Pre
11011101	General Chemistry (1)	3	3	-
11011281	General Biology	3	3	-
11021101	General Physics (1)	3	3	-
11031101	Calculus (1)	3	3	-
11031141	Statistics and Probabilities	3	3	11031101 Pre
11031202	Calculus (2)	3	3	11031101 Pre
	<b>Total</b>	<b>21</b>	21	

### 2.2Faculty Requirements Electives: (0 Credit Hours)

### 3. Department Requirements (87 Credit Hours)

#### 3.1. Compulsory Department Requirements: (75 Credit Hours)

Course No.	Course Name	Hrs.	Prerequisite
08012152	Curricula of Sciences and Teaching Methods	3	4 <sup>th</sup> level
11011103	General Chemistry Laboratory (1)	1	11011101 Sim
11011202	General Chemistry (2)	3	11011101 Pre
11011204	General Chemistry Laboratory (2)	1	11011103 Pre 11011202 Sim
11012111	Organic Chemistry (1)	3	11011202 Pre
11012121	Inorganic Chemistry (1)	3	11011202 Pre
11012131	Analytical Chemistry	3	11011202 Pre
11012132	Analytical Chemistry Laboratory	1	11011204 Pre 11012131 Sim
11012212	Organic Chemistry (2)	3	11012111 Pre
11012213	Organic Chemistry Laboratory	2	11011204 Pre 11012212 Sim
11012222	Inorganic Chemistry (2)	3	11012121 Pre
11012223	Inorganic Chemistry Laboratory	3	11011204 Pre 11012222 Sim
11012241	Physical Chemistry (1)	2	11011202 Pre 11032164 Pre
11012242	Physical Chemistry Laboratory (1)	3	11011204 Pre 11012241 Sim
11013133	Instrumental Analysis (1)	3	11012131 Pre
11013134	Electro Analytical Chemistry	3	11012131 Pre
11013143	Physical Chemistry (2)	3	11012241 Pre
11013144	Physical Chemistry Laboratory (2)	2	11012242 Pre 11013143 Sim
11013214	Systematic Identification of Organic Compounds	3	11012212 Pre 11012213 Pre
11013215	Chemistry of Biomolecules	3	11012212 Pre
11013224	Inorganic Chemistry (3)	3	11012222 Pre
11013235	Instrumental Analysis (2)	3	11013133 Pre
11013236	Instrumental Analysis Laboratory	1	11012132 Pre 11013235 Sim
11013251	Industrial Chemistry (1)	3	11012241 Pre
11014145	Physical Chemistry (3)	3	11013143 Pre
11014291	Research paper and seminar	1	Department approval
11014292	Practical Chemical Training	3	4 <sup>th</sup> level
11021103	General Physics Laboratory (1)	1	11021101 Sim
11021202	General Physics (2)	3	11021101 Pre

<b>11032164</b>	Ordinary Differential Equations	3	11031202 Pre
	<b>Total</b>	<b>75</b>	

### 3.2 Department Electives: (12 Credit Hours)

Course No.	Course Title	Hrs.	Prerequisite
11013216	Biochemistry	3	11012212 Pre
11014117	Chemistry of Natural Products	3	11012212 Pre
11014118	Chemistry of Heterocyclic Compounds	3	11012212 Pre
11014137	Environmental Chemistry	3	11013131 Pre
11014138	Special Topics in Analytical Chemistry	3	11013235 Pre
11014146	Chemistry of Surfaces and Colloids	3	11013143 Pre
11014152	Industrial Chemistry (2)	3	11013251 Pre
11014161	Computer Applications in Chemistry	3	06051211 Pre
11014219	Medicinal Chemistry	3	11012212 Pre
11014225	Organometallic Chemistry	3	11012222 Pre
11014226	Nuclear and Radiochemistry	3	11013224 Pre
11014247	Special Topics in Physical Chemistry	3	11013143 Pre
11014253	Polymer Chemistry	3	11012212 Pre
11014271	Special Topics in Chemistry		department Approval
11014272	Experimental Chemical Research	3	department Approval

### 4. Support Courses (0 Credit Hours)

### 5. Free Electives: 3 Credit Hours

Course No.	Course Title	Hrs.	Prerequisite	Corequisite
	<b>Total</b>	<b>3</b>		

## Study Plan Guide for the Bachelor Degree in Chemistry

First Year				
First Term				
Course No.	Course Title	Hrs.	Corequisite	
11011101	General Chemistry (1)	3	-	
11031101	Calculus (1)	3	-	
11021101	General Physics (1)	3	-	
11011103	General Chemistry Laboratory (1)	1	11011101 Sim	
-	University Elective Requirement	3	-	
-	University Elective Requirement	3	-	
<b>Total</b>		<b>16</b>		
Second Term				
Course No.	Course Title	Hrs.	Prerequisite	Corequisite
11011202	General Chemistry (2)	3	11011101	-
11011204	General Chemistry Laboratory (2)	1	11011103	11011202
11031202	Calculus (2)	3	1102181	-
11021202	General Physics (2)	3	1102101	-
11021103	General Physics Laboratory (1)	1	11021101	11021101
-	University Compulsory Requirement	3	-	-
-	University Elective Requirement	3	-	-
<b>Total</b>		<b>17</b>		

Second Year				
First Term				
Course No.	Course Title	Hrs.	Prerequisite	Corequisite
11012111	Organic Chemistry (1)	3	11011202	
11012121	Inorganic Chemistry (1)	3	11011202	
11012131	Analytical Chemistry	3	11011202	
11012132	Analytical Chemistry Laboratory	1	11011204	11012131
11011281	General Biology	3	-	
	University Compulsory Requirement	3		
	<b>Total</b>	<b>16</b>		
Second Term				
Course No.	Course Title	Hrs.	Prerequisite	Corequisite
11032164	Ordinary Differential Equations (1)	3	11031202	
11012212	Organic Chemistry (2)	3	11012111	
11012213	Organic Chemistry Laboratory	2	11011204	11012212
11012241	Physical Chemistry (1)	3	11011202	11032164
11012242	Physical Chemistry Laboratory (1)	2	11011204	11012241
06051211	Basic of programming	3	01100051	
	<b>Total</b>	<b>16</b>		

Third Year				
First Term				
Course No.	Course Title	Hrs.	Prerequisite	Corequisite
11012222	Inorganic Chemistry (2)	3	11012121	
11012223	Inorganic Chemistry Laboratory	3	11011204	11012222
11013214	Systematic Identification of Organic Compounds	3	11012212 11012213	
11013133	Instrumental Analysis (1)	3	11012131	
11013143	Physical Chemistry (2)	3	11012241	
11031141	Statics and Probability	3	11031101	
<b>Total</b>		<b>18</b>		
Second Term				
Course No.	Course Title	Hrs.	Prerequisite	Corequisite
11013224	Inorganic Chemistry (3)	3	11012222	
11013251	Industrial Chemistry (1)	3	11012241	
11013235	Instrumental Analysis (2)	3	11013133	
11013236	Instrumental Analysis Laboratory	1	11012132	11013235
11013134	Electro Analytical chemistry	3	11012131	
11013144	Physical Chemistry Laboratory (2)	2	11012242	11013143
-	University Elective Requirement	3	-	
<b>Total</b>		<b>18</b>		

Fourth Year				
First Term				
Course No.	Course Title	Hrs.	Prerequisite	Corequisite
11014145	Physical Chemistry (3)	3	1101231	
11014291	Research Paper and Seminar	1	Department approval	
11013215	Chemistry of Biomolecules	3	11012212	
	Department Elective Requirement	3		
	Department Elective Requirement	3		
	University Compulsory Requirement	3		
<b>Total</b>		<b>16</b>		
Second Term				
Course No.	Course Title	Hrs.	Prerequisite	Corequisite
11014292	Practical Chemical Training	3	Fourth level	
08012152	Curricula of Sciences and Teaching Methods	3	Fourth level	
	Department Elective Requirement	3		
	Department Elective Requirement	3		
	University Elective Requirement	3		
	Free Requirement	3		
<b>Total</b>		<b>18</b>		

## Description of Courses offered by the Department of Chemistry

<b>11011101</b>	<b>General Chemistry (1)</b>	<b>3 Credit Hours</b>	<b>Prerequisite:- No</b>
Introduction; atoms, molecules and ions; Stoichiometry; Reactions in chemical solutions; Atomic structure; periodic table, Chemical bonding (I): covalent bonds; chemical bonding (II): Molecular geometry and hybridization; gases.			
<b>11011103</b>	<b>General Chemistry Laboratory (1)</b>	<b>1 Credit Hour</b>	<b>11011101 Sim</b>
Laboratory safety, laboratory equipment's, qualitative analysis through experiments to detect some negative and positive ions in solutions, quantitative analysis through experiments to determine the density of solids and liquids, the empirical formula of chemical compounds, Limiting reactant, and volumetric analysis, and the determination of molecular weight for volatile liquids.			
<b>11011202</b>	<b>General Chemistry (2)</b>	<b>3 Credit Hours</b>	<b>11011101 Pre</b>
Molecular and intermolecular forces, liquids and solids, physical properties of solutions, kinetic chemistry, chemical equilibrium, acids and bases, acid equilibrium: solubility base and equilibrium, energy relations in chemical reactions. Thermochemistry (Thermodynamics).			
<b>11011204</b>	<b>General Chemistry Laboratory (2)</b>	<b>1 Credit Hour</b>	<b>11011103 Pre 11011202 Sim</b>
Experiments in determining: molar solubility, solubility constant of materials, equilibrium constant by spectroscopy, rate law of chemical reaction, molecular weight through colligative properties, pH, Bleach analysis Buffer solutions, Letchatelier principle and thermochemistry.			
<b>11012111</b>	<b>Organic Chemistry (1)</b>	<b>3 Credit Hours</b>	<b>11011202 Pre</b>
Structure and chemical bonding, Polar covalent bonds; Organic acids and bases; Organic compounds: alkanes and their stereochemistry; Organic compounds: cyclic alkanes and stereochemistry; alkenes: reactions and methods of preparation; alkynes: Introduction to organic synthesis; stereochemistry; organic halides; Alkyl halide reactions: replacement and elimination.			
<b>11012212</b>	<b>Organic Chemistry (2)</b>	<b>3 Credit Hours</b>	<b>11012111 Pre</b>
Benzene and aromaticity; benzene chemistry; alcohols and phenols; ethers and epoxy compounds; thiols compounds; aldehydes and ketones; carboxylic acids and amides; carboxylic acid derivatives; substitution reactions; amines and heterocyclic compounds; determination of organic compounds structure by Mass spectroscopy and infrared spectroscopy; determination			

of organic compounds structure by nuclear magnetic resonance (NMR) and UV-visible spectroscopy.

**11012213 Organic Chemistry Laboratory 2 Credit Hours 11011204 Pre 11012212 Sim**

Melting point; simple and fractional distillation; crystallization; extraction; steam distillation; chromatography; experiments in the synthesis of a number of organic compounds using different methods; experiments in identifying functional groups using different methods.

**11013214 Systematic Identification of Organic Compounds 3 Credit Hours 11012212 Pre 11012213 Pre**

Diagnosis of unidentified organic compounds by specifying their physical properties (melting point, boiling point, and solubility), conduct the classification tests for functional groups, spectroscopic analysis, and the conversion of a compound to another (derivatives).

**11013215 Chemistry of Biomolecules 3 Credit Hours 11012212 Pre**

Introduction to the structure, properties, and functions of simple and complex biomolecules: amino acids, peptides, proteins, enzymes, carbohydrates, fats, and nucleic acids.

**11012121 Inorganic Chemistry (1) 3 Credit Hours 11011202 Pre**

Atomic structure; molecular structure and bonding; ionic bonding; lattice energy; packing and ionic sizes; Born-Haber cycle and applications; aqueous solution; acids and bases and non-aqueous solvents.

**11012222 Inorganic Chemistry (2) 3 Credit Hours 11012121 Pre**

Introduction to symmetry and group theory. Principles of coordination chemistry: Nature of ligands; Nomenclature; Coordination numbers; Isomerism. Theories of bonding in coordination compounds. Magnetic and spectroscopic properties of coordination compounds. Reaction mechanisms of d-metal complexes.

**11012223 Inorganic Chemistry Laboratory 3 Credit Hours 11011204 Pre 11012222 Sim**

Experiments in Synthesis and characterization of transition –metal complexes.; Characterization methods used are: melting point determination, Electrical conductance; IR ; UV/VIS.

**11013224 Inorganic Chemistry (3) 3 Credit Hours 11012222 Pre**

Some aspects of molecular structure and bonding; chemistry of hydrogen; chemistry of the main group elements: groups: IA (alkali); IIA (alkaline earth); IIIA-VIA-VIA; VIIA (halogens); VIII (noble gases). Lanthanides and Actinides.

**11012131 Analytical Chemistry 3 Credit Hours 11011202 Pre**

The nature of analytical chemistry; calculations used in analytical chemistry; errors in chemical analysis; statistical data processing and evaluation; aqueous solutions and chemical equilibrium; the effect of electrolytic molecules on chemical equilibrium; solving equilibrium problems of complex systems; gravimetric analysis methods; calibration in analytical chemistry; Neutralization titration principles (acids and bases); Compleximetric titration, Precipitation titration.

**11012132 Analytical Chemistry 1 Credit Hour 11011204 Pre  
Laboratory 11012131 Sim**

Acid-base titration; Precipitation reactions titration (determination of chloride ion using Mohre and Volhard methods); compleximetric titration (determination of calcium, magnesium ions and water hardness); Redox titration (determination of iron and vitamin C); gravimetric analysis.

**11013133 Instrumental Analysis (1) 3 Credit Hours 11012131 Pre**

Introduction to different types of calibration and analysis method; properties of electromagnetic radiation and their interactions with matter, components of spectrophotometry instruments; molecular and atomic spectra; atomic absorption (flame and graphite furnace); emission spectroscopy (arc, spark and plasma); UV absorption spectroscopy.

**11013134 Electrochemistry 3 Credit Hours 11012131 Pre**

Oxidation and reduction reactions, galvanic cells, standard electrode potentials, oxidation - reduction titrations, applications to oxidation - reduction titrations, Potentiometry, electro-gravimetric methods, coulometric methods, voltammetry, and polarography.

**11013235 Instrumental Analysis (2) 3 Credit Hours 11013133 Pre**

Principle of Infrared instruments and their Applications; Principle of Mass Spectrometer; Mass analyzer; Chromatography Theory; Gas Chromatography; High Performance Liquid Chromatography; Supercritical Fluid Chromatography; applications of Chromatography-Mass Spectrometry in Various Branches of Chemistry Organic and inorganic.

**11013236 Instrumental Analysis 1 Credit Hour 11012132 Pre  
Laboratory 11013235 Sim**

Experiments in qualitative and quantitative analysis using a number of different chemical analysis instruments including conductivity meter, atomic absorption, atomic emission, UV-visible spectrophotometer, gas chromatograph, and high-performance liquid chromatography.

**11012241 Physical Chemistry (1) 3 Credit Hours 11011202 Pre  
11032164 Pre**

Experiments in qualitative and quantitative analysis using a number of different chemical analysis instruments including conductivity meter, atomic absorption, atomic emission, UV-visible spectrophotometer, gas chromatograph, and high-performance liquid chromatography.

**11012242 Physical Chemistry Laboratory (1) 2 Credit Hours 11011202 Pre  
11012241 Sim**

Experiments in thermodynamics, thermochemistry, chemical equilibrium, solutions and phase equilibrium.

**11013143 Physical Chemistry (2) 3 Credit Hours 11012241 Pre**

Solutions of electrolytes, Electrochemical cells, chemical kinetics (I): basic ideas, chemical kinetics (II): composite mechanism, surface chemistry and colloids, and transport properties.

**11013144 Physical Chemistry Laboratory (2) 2 Credit Hours 11012242 Pre  
11013143 Sim**

Experiments in electrolytic solutions (determination of solubility product constant of silver chloride salt and dissociation constant of weak acid by measuring conductivity); experiments in kinetic chemistry (determination the order of chemical reaction and rate law for several types of chemical reactions based on different methods); experiments in surface chemistry (Adsorption).

**11014145 Physical Chemistry (3) 3 Credit Hours 11013143 Pre**

Basic principles in quantum chemistry, electromagnetic radiation and ancient quantum theory, quantum mechanics for simple systems (free body, body inside a box with one, two and three dimensions, rigid rotor, harmonic oscillator); atomic and molecular structure; methods of approximation in Quantum mechanics; the basics of vibration, rotation, and electronic transmission spectrum in molecules.

**11013251 Industrial Chemistry (1) 3 Credit Hours 11012241 Pre**

Basic consideration, characteristics of the chemical industry, raw materials for chemical industry, production processes for organic chemical industries, basic chemicals from petroleum, industrial polymers, detergents, selected industrial processes.

**11014291    Research Paper and Seminar                    1 Credit Hour                    Department approval**

Scientific research methods, scientific sources of information, writing a research paper, preparing for presentation about a specific topic in the field of chemistry.

**11014292    Practical Chemical Training                    3 Credit Hour                    Fourth level**

Training in an organization that adopts chemical analysis such as factories of cement, potash, phosphate, petroleum refinery.... etc, pharmaceutical companies, and water companies where the student spend 135 training hours. Student is evaluated by the train.

**11013216    Biochemistry                    3 Credit Hour                    11012212 Pre**

Introduction to biochemistry, mechanisms of biological processes, the molecular nature of biological components, dynamic aspects of biochemical reactions.

**11014117    Chemistry of Natural Products                    3 Credit Hour                    11012212 Pre**

Introduction to natural active metabolites including their biological pathways; extraction methods; determination of the structural composition of some natural chemical compounds and their therapeutic utilization; principles of chromatographic techniques used in the discovery of new medicines from natural sources.

**11014118    Chemistry of Heterocyclic Compounds                    3 Credit Hour                    11012212 Pre**

Basic principles of heterocyclic chemistry; Preparation of a number of heterocyclic compounds; Reactions of a number of heterocyclic compounds; applications and uses of heterocyclic compounds in various fields.

**11014219    Medicinal Chemistry                    3 Credit Hour                    11012212 Pre**

Introduction to medicinal chemistry; the physical and chemical properties of medicinal compounds; medicinal reactions related to biological activity; basic principles of medicine design; chemistry of medicines operating the central nervous system (central nervous system), the autonomic nervous system (ANS), the cardiovascular system, and the antihistamine factors

**11014225    Organometallic Chemistry                    3 Credit Hour                    11012222 Pre**

Structures and electronic properties of organometallic compounds; reactions of organometallic compounds; the uses of organometallic compounds in catalysis and in organic chemistry.

**11014226 Nuclear and Radiochemistry 3 Credit Hour 11013224 Pre**

Introduction to radiation and nuclear chemistry; nuclear structure and bonding energy; processes of radioactive decay; equations of radioactive decay and growth; radiation interference with matter; nuclear energy; applications of nuclear chemistry.

**11014137 Environmental Chemistry 3 Credit Hour 11012131 Pre**

Introduction to environmental chemistry; components of the environment (atmosphere, soil and water); chemical compounds in the environment and their sources; chemical reactions and processes in the environment with all its components; environmental problems; analytical methods used to monitor the chemical components of air, water, and soil.

**11014138 Special Topics in Analytical Chemistry 3 Credit Hour 11013235 Pre**

Advanced topics in the field of analytical chemistry, Instrumental analysis and chromatography, the lecturer chooses the appropriate topics that meet student's needs.

**11014146 Colloid and Surface Chemistry 3 Credit Hour 11013141 Pre**

Introduction to colloidal and surface chemistry; tools used in colloidal and surface chemistry; sedimentation and diffusion; viscosity; surface tension; light scattering; colloidal structure in surface solution; emulsions and microemulsions and their applications.

**11014152 Industrial Chemistry (2) 3 Credit Hour 11013151 Pre**

kinetics of industrial chemistry; industrial chemistry and catalysts; industrial separation processes; production processes for industrial inorganic chemicals; large-scale chemical industries, salts industry, chemicals sources other than natural gas and oil.

**11014253 Polymer Chemistry 3 Credit Hour 06051112 Pre**

Classification and naming of polymers; chemical structure of polymers and physical properties; methods for determining the molecular weight of polymers; polymers in solutions and their

viscosity, one-step polymer reactions, chain polymerization reactions, co-polymerization, polymerization process technology.

**11014161 Computer Applications in Chemistry 3 Credit Hour 06051211 Pre**

Introduction to the importance of the use of computer in chemistry; using Microsoft word processor in writing scientific articles and mathematical equations in the field of chemistry; using Microsoft excel processor in various chemical calculations, statistical analysis, and graphing; Using special programs for writing chemical equations, drawing chemical compounds, finding spectra of chemical compounds, and design scientific experiments; search for data; using Microsoft PowerPoint processor to design presentations in different topics.

**11014271 Selected Topics in Chemistry 3 Credit Hour Department approval**

Selected topics from different cognitive fields in chemistry (organic, inorganic, analytical and physical) according to the specialty of the faculty member who teach the course.

**11014272 Experimental Chemical Research 3 Credit Hour Department approval**

Student works on a practical research project under the supervision of one of the faculty members in the department, so that student works for six hours per week and provides a weekly work report.

**11014247 Special Topics in Physical Chemistry 3 Credit Hour 11013143Pre**

Student works on a practical research project under the supervision of one of the faculty members in the department, so that student works for six hours per week and provides a weekly work report.