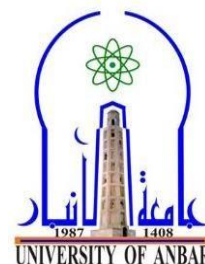


University of Anbar جامعة الانبار



First Cycle – Bachelor's Degree (B.Sc.) - Chemistry

بكالوريوس – علوم كيمياء



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1. Overview

This catalogue is about the courses (modules) given by the program of Chemistry to gain the Bachelor of Science degree. The program delivers (46) Modules with (6000) total student workload hours and 240 total ECTS. The module delivery is based on the Bologna Process.

نظرة عامة

يتناول هذا الدليل المواد الدراسية التي يقدمها برنامج قسم علوم الكيمياء للحصول على درجة بكالوريوس العلوم. يقدم البرنامج (٤٦) مادة دراسية مع (٦٠٠٠) إجمالي ساعات حمل الطالب و ٢٤٠ إجمالي وحدات أوروبية. يعتمد تقديم المواد الدراسية على عملية بولونيا.

2. Undergraduate Courses 2023-2024

Module 1

Code	Course/Module Title	ECTS	Semester
Che-111	Analytical(1)	7.00	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/3/0/1	94	81
Description			
Analytical chemistry is the branch of chemistry that deals with the analysis of different substances, and it involves the separation, identification, and the quantification of matter. by using of classical methods along with modern scientific instruments to achieve all these purposes. Analytical chemistry is often described as the area of chemistry responsible for: 1. Characterizing the composition of matter, both qualitatively and quantitatively. 2. Improving established analytical methods. 3. Extending existing analytical methods to new types of samples. 4. Developing new analytical methods for measuring chemical phenomena.. Practical classes take the form of a directed research project closely integrated with the theory course.			

Module 2

Code	Course/Module Title	ECTS	Semester
Che-112	Inorganic (1)	7.00	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/0/0/2	94	81

Description
Inorganic chemistry is a field of chemistry that studies chemical compounds and their reactions and concerned with the properties and behavior of inorganic compounds, which include metals, minerals, and organometallic.

Module 3

Code	Course/Module Title	ECTS	Semester
CoS-113	geology	4.00	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0	48	77
Description			
Geology is the scientific study of planet Earth and involves the observation and interpretation of processes that form and change our world. Some of these processes, such as earthquakes, tsunamis, and volcanic eruptions, proceed rapidly, often with catastrophic consequences. Others, such as erosion or mountain building can progress so slowly that their results are scarcely noticeable over a human lifetime. Each of these processes, however, can exert a profound influence on human activities and can, in turn, be influenced intentionally or unintentionally by human activities. Environmental Science investigates the many interconnected systems and processes that formed our world, continuously change it, and, ultimately, sustain life on it. The Environmental Science Program at Wayne State offers an interdisciplinary approach combining a strong foundation from both geological and ecological perspectives, and a broad choice of electives in its course work. This interdisciplinary program addresses human impacts on the environment, earth surface processes, and ecosystem science with an emphasis on the urban environments. It will prepare students for graduate study, or for careers in various areas of environmental science including conservation, restoration, watershed management, environmental impact assessment, air and water quality monitoring, regulatory compliance, and environmental remediation.			

Module 4

Code	Course/Module Title	ECTS	Semester
Che-114	Laboratory Sefty	4.00	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0	48	52
Description			
Laboratory safety involves recognizing and evaluating hazards, assessing risks, selecting appropriate personal protective equipment, and performing the experimental work in a safe manner. Training must start early in a chemist's career and refers to the set of practices, procedures, and guidelines designed to ensure the well-being of individuals working in a laboratory environment. Laboratories are places where scientific research, experiments, and analyses take place, and they can involve various types of equipment, chemicals, and potential hazards. Therefore, it is crucial to establish and adhere to safety measures to prevent accidents, injuries, and the release of harmful substances.			

Module 5

Code	Course/Module Title	ECTS	Semester
UoA-115	Human Rights and freedoms	4.00	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0	48	27
Description			
Increase the student's knowledge of the theoretical conceptual aspect and historical development of the subject of human rights and democracy. Develop the student's analytical and critical skills regarding the reality and future of human rights and democracy, train the student on the importance of active participation in aspects of public life such as enhancing respect for the principles of general human rights and active participation in political and cultural life. Enabling students to understand the importance of education and its role in spreading the culture of human rights and democracy in building a civilized society based on good governance, the most important components of which are belief in human rights, education on them, and active participation in governance through free and fair elections.			

Module 6

Code	Course/Module Title	ECTS	Semester
UoA-116	Arabic Language (1)	4.00	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0	63	37
Description			
Developing students' knowledge of the Arabic language and its importance to them. To learn the explanation of some Surah's of the Holy Quran and memorize them. To introduce the student to the history of literature and the most important stages of its development. To learn about poets that the student has not previously known. To control spelling and punctuation marks. The ability to memorize and recall, to balance the language of the literature of the mentioned era with other literatures. Group participation in the literary contents of the subject. The ability to make suggestions and solve problems. The student collects a large amount of vocabulary and meanings and learns how to search in Arabic dictionaries and lexicons.			

Module7

Code	Course/Module Title	ECTS	Semester
Che-121	Analytical 2	7.00	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/3/0/2	79	96
Description			

Analytical chemistry is the branch of chemistry that deals with the analysis of different substances, and it involves the separation, identification, and the quantification of matter. by using of classical methods along with modern scientific instruments to achieve all these purposes. Analytical chemistry is often described as the area of chemistry responsible for:

1. Characterizing the composition of matter, both qualitatively and quantitatively.
2. Improving established analytical methods.
3. Extending existing analytical methods to new types of samples.
4. Developing new analytical methods for measuring chemical phenomena..

Practical classes take the form of a directed research project closely integrated with the theory course.

Module 8

Code	Course/Module Title	ECTS	Semester
Che-122	Inorganic 2	7.00	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/0/0/2	79	96
Description			
Inorganic chemistry deals with synthesis and behavior of inorganic and organometallic compounds. This field covers chemical compounds that are not carbon-based, which are the subjects of organic chemistry. The distinction between the two disciplines is far from absolute, as there is much overlap in the sub discipline of organometallic chemistry. It has applications in every aspect of the chemical industry, including catalysis, materials science, pigments, surfactants, coatings, medications, fuels, and agriculture			

Module 9

Code	Course/Module Title	ECTS	Semester
CoS-123	Mathematics I	3.00	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/0/0/2	48	27
Description			
Mathematics is the abstract science of numbers, quantity and space. Mathematics may be studied in its own right (pure mathematics), or as it is applied to other disciplines such as physics and engineering (applied mathematics). Statistics is the science of collecting and analyzing numerical data in large quantities, especially for the purpose of inferring proportions as a whole from those in a representative sample. Most mathematics and statistics majors, however, use their problem-solving skills in the business world – analyzing processes, data, and algorithms, or in government research. Employers hire mathematics and statistics majors because employers know those students are able to work on hard problems, and to make logical decisions.			

Module 10

Code	Course/Module Title	ECTS	Semester
CoS-124	Physics	5.00	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	64	61

Description
Physics is the natural science of matter, involving the study of matter, its fundamental constituents, its motion and behavior through space and time, and the related entities of energy and force. Physics is one of the most fundamental scientific disciplines. Physics is one of the oldest academic disciplines and, through its inclusion of astronomy, perhaps the oldest. Over much of the past two millennia, physics, chemistry, biology, and certain branches of mathematics were a part of natural philosophy, but during the Scientific Revolution in the 17th century these natural sciences emerged as unique research endeavors in their own right. Physics intersects with many interdisciplinary areas of research, such as biophysics and quantum chemistry, and the boundaries of physics are not rigidly defined .

Module 11

Code	Course/Module Title	ECTS	Semester
UoA-125	Computers program	4.00	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
1	0/2/0 /0	64	36
Description			
Computer Science is the study of computers and computational systems, in which computer scientists deal mostly with software and software systems; this includes their theory, design, development, and application. Principal areas of study within Computer Science include Microsoft Word, Excel, PowerPoint, artificial intelligence, computer systems and networks, security, database systems, human computer interaction, vision and graphics, numerical analysis, bioinformatics and theory of computing			

Module 12

Code	Course/Module Title	ECTS	Semester
UoA-126	English Language	4.00	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0	63	37
Description			
The course aims to develop communicative competence in English for intercultural contexts by teaching language items and communicative strategies essential for such scenarios, while at the same time giving students ample chances to output such items. The aims of this course are reflected in the content, which contains several themes, such as cultural awareness, intercultural awareness and English as a global language. Indicative content includes understanding the uniqueness of your own culture and other cultures, as well as being aware of the role culture plays in communication in English as a global language. In addition, this course allows for discussions about what it means for English to be a global language of communication and how misunderstandings and miscommunications when using English occurs. The course also includes practice in the pronunciation features that help improve intelligibility in intercultural contexts.			

Module 13

Code	Course/Module Title	ECTS	Semester
UOA104	Crimes of Baath	1.00	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
1	0	17	7
Description			
The student should know what crime is and what its types are • will be able to explain and clarify the crimes committed by the Baath regime in Iraq • For students to be familiar with international and local laws that criminalize the actions carried out by the Baath regime in Iraq • The student's awareness of the extent of the crimes committed by the Baath regime in Iraq by highlighting those crimes • .should be able to give examples of these crimes and the places where they occur • The learner should know the psychological and social effects of the crimes committed by the Baath regime on the personality of the Iraqi citizen • The learner should know the environmental effects of the crimes committed by the Baath regime on the environment of Iraq • The learner will know the graves left behind by the defunct Baath regime, specifying their location and time of occurrence			

Module 14

Code	Course/Module Title	ECTS	Semester
Che-211	Analytical 3	6.00	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/1	79	71
Description			
Analytical chemistry is the branch of chemistry that deals with the analysis of different substances, and it involves the separation, identification, and the quantification of matter. by using of classical methods along with modern scientific instruments to achieve all these purposes. Analytical chemistry is often described as the area of chemistry responsible for: 1. Characterizing the composition of matter, both qualitatively and quantitatively. 2. Improving established analytical methods. 3. Extending existing analytical methods to new types of samples. 4. Developing new analytical methods for measuring chemical phenomena.. Practical classes take the form of a directed research project closely integrated with the theory course.			

Module 15

Code	Course/Module Title	ECTS	Semester
Che-212	Inorganic 3	6.00	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	71
Description			

Inorganic chemistry study that inorganic compounds exhibit a range of bonding properties. Some are ionic compounds, consisting of very simple cations and anions joined by ionic bonds. Examples of salts (which are ionic compounds) are magnesium chloride MgCl_2 , which consists of magnesium cations Mg^{2+} and chloride anions Cl^- ; or sodium hydroxide NaOH , which consists of sodium cations Na^+ and hydroxide anions OH^- . Some inorganic compounds are highly covalent, such as sulfur dioxide and iron pentacarbonyl. Many inorganic compounds have polar covalent bonds, a form of bonding intermediate between covalent and ionic bonds. This description applies to many oxides, carbonates, and halides. Many inorganic compounds have high melting points. Some salts (such as sodium chloride) are highly soluble in water. When one of the reactants contains hydrogen atoms, the reaction can occur by exchanging protons in acid-base chemistry. In a more general definition, any chemical species capable of bonding with electron pairs is called a Lewis acid; conversely, any molecule that tends to donate a pair of electrons is referred to as a Lewis base.[5] As a refinement of acid-base reactions, the HSAB theory takes into account polarizability and ion size

Module 16

Code	Course/Module Title	ECTS	Semester
Che-213	Physical Chemistry 1	5.00	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	64	61
Description			
physical chemistry Thermodynamics that study the concepts of heat and temperature and the inter-conversion of heat and other forms of energy. The four laws of thermodynamics govern the behavior of these quantities and provide a quantitative description. William Thomson, in 1749, coined the term thermodynamics. Thermodynamics in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter. To be specific, it explains how thermal energy is converted to or from other forms of energy and how matter is affected by this process. Thermal energy is the energy that comes from heat. This heat is generated by the movement of tiny particles within an object, and the faster these particles move, the more heat is generated			

Module 17

Code	Course/Module Title	ECTS	Semester
Che-214	Organic Chemistry 1	5.00	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	64	61
Description			
Organic chemistry is a sub discipline within chemistry involving the scientific study of the structure, properties, and reactions of organic compounds and organic materials, i.e., matter in its various forms that contain carbon atoms. Study of structure determines their structural formula. Study of properties includes physical and chemical properties, and evaluation of chemical reactivity to understand their behavior. The study of organic reactions includes the chemical synthesis of natural products, drugs, and polymers, and study of individual organic molecules in the laboratory and via theoretical study.			

Module 18

Code	Course/Module Title	ECTS	Semester
Sci-215	Cytology	5.00	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	64	61
Description			
Cytology is a branch of biology that studies the structure, function, and behavior of cells. All living organisms are made of cells. A cell is the basic unit of life that is responsible for the living and functioning of organisms. Cytology is the study of the structural and functional units of cells. Cytology encompasses both prokaryotic and eukaryotic cells and has many subtopics which may include the study of cell metabolism, cell communication, cell cycle, biochemistry, and cell composition. The study of cells is performed using several microscopy techniques, cell culture, and cell fractionation. These have allowed for and are currently being used for discoveries and research pertaining to how cells function, ultimately giving insight into understanding larger organisms. Knowing the components of cells and how cells work is fundamental to all biological sciences while also being essential for research in biomedical fields such as cancer, and other diseases. Research in Cytology is interconnected to other field such as cytochemistry.			

Module 19

Code	Course/Module Title	ECTS	Semester
Sci-216	Mathematics II	3.00	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0	48	27
Description			
Mathematics is the abstract science of numbers, quantity and space. Mathematics may be studied in its own right (pure mathematics), or as it is applied to other disciplines such as physics and engineering (applied mathematics). Statistics is the science of collecting and analyzing numerical data in large quantities, especially for the purpose of inferring proportions as a whole from those in a representative sample. Most mathematics and statistics majors, however, use their problem-solving skills in the business world – analyzing processes, data, and algorithms, or in government research. Employers hire mathematics and statistics majors because employers know those students are able to work on hard problems, and to make logical decisions.			

Module 20

Code	Course/Module Title	ECTS	Semester
Che-221	Analytical 4	6.00	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/1	79	71
Description			

Most of the time the substances that we see around us are not in their pure form. They are basically a mixture of two or more substances. Interestingly, mixtures tend to also come in different forms. Therefore, there are several types of separation techniques that are used in segregating a mixture of substances. As for the need for separation, it is usually done to remove all the unwanted materials and obtain useful components. Some of the common methods of separating substances or mixtures are: Handpicking, Threshing, Winnowing, Sieving, Evaporation, Distillation, Filtration or Sedimentation, Separating Funnel and Magnetic Separation

Module 21

Code	Course/Module Title	ECTS	Semester
Che-222	Inorganic 4	6.00	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	71
Description			
Symmetry in inorganic chemistry refers to the arrangement and orientation of atoms within a molecule or crystal structure. It is a fundamental concept that helps chemists understand the geometric properties, bonding, and physical characteristics of inorganic compounds. The symmetry of a molecule or crystal is determined by the positions and arrangements of its atoms relative to one another. Molecules and crystals can exhibit various types of symmetry, such as rotational symmetry, reflection symmetry, and improper rotation symmetry. These symmetry operations describe how the object can be transformed without changing its appearance.			

Module 22

Code	Course/Module Title	ECTS	Semester
Che-223	Physical Chemistry 2	5.00	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	64	61
Description			
physical chemistry Thermodynamics that study the concepts of heat and temperature and the inter-conversion of heat and other forms of energy. The four laws of thermodynamics govern the behavior of these quantities and provide a quantitative description. William Thomson, in 1749, coined the term thermodynamics. Thermodynamics in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter. To be specific, it explains how thermal energy is converted to or from other forms of energy and how matter is affected by this process. Thermal energy is the energy that comes from heat. This heat is generated by the movement of tiny particles within an object, and the faster these particles move, the more heat is generated			

Module 23

Code	Course/Module Title	ECTS	Semester
Che-224	Organic Chemistry 2	5.00	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	64	61
Description			

Organic chemistry is a sub discipline within chemistry involving the scientific study of the structure, properties, and reactions of organic compounds and organic materials, i.e., matter in its various forms that contain carbon atoms. Study of structure determines their structural formula. Study of properties includes physical and chemical properties, and evaluation of chemical reactivity to understand their behavior. The study of organic reactions includes the chemical synthesis of natural products, drugs, and polymers, and study of individual organic molecules in the laboratory and via theoretical study.

Module 24

Code	Course/Module Title	ECTS	Semester
Che-225	Nanotechnology	5.00	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	64	61
Description			
Nanotechnology study the manipulation of matter with at least one dimension sized from 1 to 100 nanometers (nm). At this scale, commonly known as the Nano scale, surface area and quantum mechanical effects become important in describing properties of matter. This definition of nanotechnology includes all types of research and technologies that deal with these special properties. It is common to see the plural form "nanotechnologies" as well as "Nano scale technologies" to refer to research and applications whose common trait is scale. An earlier understanding of nanotechnology referred to the particular technological goal of precisely manipulating atoms and molecules for fabricating macro scale products, now referred to as molecular nanotechnology. Nanotechnology defined by scale includes fields of science such as surface science, organic chemistry, semiconductor physics, energy storage, engineering, microfabrication, and molecular engineering. The associated research and applications range from extensions of conventional device physics to molecular self-assembly.			

Module 25

Code	Course/Module Title	ECTS	Semester
Che-226	Statistical	3.00	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2/1	48	27
Description			
Statistical is the discipline that concerns the collection, organization, analysis, interpretation, and presentation of data. In applying statistics to a scientific, industrial, or social problem, it is conventional to begin with a statistical population or a statistical model to be studied. When census data cannot be collected, statisticians collect data by developing specific experiment designs and survey samples. Two main statistical methods are used in data analysis: descriptive statistics, which summarize data from a sample using indexes such as the mean or standard deviation, and inferential statistics, which draw conclusions from data that are subject to random variation.			

Module 26

Code	Course/Module Title	ECTS	Semester
Che-312	Inorganic chemistry 5	6.00	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	71
Description			
A coordination complex is a chemical compound consisting of a central atom or ion, which is usually metallic and is called the coordination center, and a surrounding array of bound molecules or ions, that are in turn known as ligands or complexing agents. Many metal-containing compounds, especially those that include transition metals (elements like titanium that belong to the periodic table's d-block), are coordination complexes.			

Module 27

Code	Course/Module Title	ECTS	Semester
Che-313	Physical chemistry 3	6.00	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	71
Description			
Electrochemistry is the branch of physical chemistry concerned with the relationship between electrical potential difference and identifiable chemical change. These reactions involve electrons moving via an electronically-conducting phase (typically an external electrical circuit, but not necessarily, as in electroless plating) between electrodes separated by an ionically conducting and electronically insulating electrolyte (or ionic species in a solution). When a chemical reaction is driven by an electrical potential difference, as in electrolysis, or if a potential difference results from a chemical reaction as in an electric battery or fuel cell, it is called an electrochemical reaction. Unlike in other chemical reactions, in electrochemical reactions electrons are not transferred directly between atoms, ions, or molecules, but via the aforementioned electronically-conducting circuit. This phenomenon is what distinguishes an electrochemical reaction from a conventional chemical reaction			

Module 28

Code	Course/Module Title	ECTS	Semester
Che-314	Organic chemistry 3	6.00	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	71
Description			
Organic chemistry is a sub discipline within chemistry involving the scientific study of the structure, properties, and reactions of organic compounds and organic materials, i.e., matter in its various forms that contain carbon atoms. Study of structure determines their structural formula. Study of properties includes physical and chemical properties, and evaluation of chemical reactivity to understand their behavior. The study of organic reactions includes the chemical synthesis of natural products, drugs, and polymers, and study of individual organic molecules in the laboratory and via theoretical study.			

Module 29

Code	Course/Module Title	ECTS	Semester
Che-315	Biochemistry 1	6.00	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	71
Description			
Biochemistry processes related to living organisms. It is a laboratory-based science combining biology and chemistry. Biochemists study the structure, composition, and chemical reactions of substances in living systems and, in turn, their functions and ways to control them.			

Module 30

Code	Course/Module Title	ECTS	Semester
Che-316	Industrial chemistry 1	4.00	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0	48	52
Description			
Industrial chemistry is the manufacturing art concerned with the transformation of matter into useful materials in useful amounts. Usually this transformation of available materials into more desirable ones involves some kind of process following a recipe. In turn the process may involve grinding, mixing together various ingredients, dissolving, heating, allowing ingredients to interact (chemically or biochemically react forming new compositions of matter), cooling, evaporating or distilling, growing crystals, filtering, and other physical-chemical-biological operations			

Module 31

Code	Course/Module Title	ECTS	Semester
Che-317	Selective 1	2.00	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0	33	17
Description			
A systematic study material is selected according to the requirements of the chemical labor market, ensuring that students are educated and benefit from scientific and practical experiences.			

Module 32

Code	Course/Module Title	ECTS	Semester
Che-312	Inorganic chemistry 5	6.00	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	71
Description			

the study of Bio inorganic Chemistry is a specialized field that integrates a wide range of chemicals elements into life, such as sodium, potassium, calcium, magnesium and many metals such as iron, cobalt, nickel and other less known, i.e., molybdenum, tungsten and vanadium, etc., without being exhaustive, the known “transition metal” of the Periodic Table, all having specific roles in metalloproteinase/enzymes, modulating its properties and performing diverse functions

Module 33

Code	Course/Module Title	ECTS	Semester
Che-313	Physical chemistry 3	6.00	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	71
Description			
Electrochemistry is the branch of physical chemistry concerned with the relationship between electrical potential difference and identifiable chemical change. These reactions involve electrons moving via an electronically-conducting phase (typically an external electrical circuit, but not necessarily, as in electroless plating) between electrodes separated by an ionically conducting and electronically insulating electrolyte (or ionic species in a solution). When a chemical reaction is driven by an electrical potential difference, as in electrolysis, or if a potential difference results from a chemical reaction as in an electric battery or fuel cell, it is called an electrochemical reaction. Unlike in other chemical reactions, in electrochemical reactions electrons are not transferred directly between atoms, ions, or molecules, but via the aforementioned electronically-conducting circuit. This phenomenon is what distinguishes an electrochemical reaction from a conventional chemical reaction			

Module 34

Code	Course/Module Title	ECTS	Semester
Che-314	Organic chemistry 3	6.00	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	71
Description			
Organic chemistry is a sub discipline within chemistry involving the scientific study of the structure, properties, and reactions of organic compounds and organic materials, i.e., matter in its various forms that contain carbon atoms. Study of structure determines their structural formula. Study of properties includes physical and chemical properties, and evaluation of chemical reactivity to understand their behavior. The study of organic reactions includes the chemical synthesis of natural products, drugs, and polymers, and study of individual organic molecules in the laboratory and via theoretical study.			

Module 35

Code	Course/Module Title	ECTS	Semester
Che-315	Biochemistry 2	6.00	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	71
Description			

Biochemistry processes related to living organisms. It is a laboratory-based science combining biology and chemistry. Biochemists study the structure, composition, and chemical reactions of substances in living systems and, in turn, their functions and ways to control them..

Module 36

Code	Course/Module Title	ECTS	Semester
Che-316	Industrial chemistry 1	4.00	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0	48	52
Description			
The chemical industry study the companies and other organizations that develop and produce industrial, specialty and other chemicals. Central to the modern world economy, it converts raw materials (oil, natural gas, air, water, metals, and minerals) into commodity chemicals for industrial and consumer products. It includes industries for petrochemicals such as polymers for plastics and synthetic fibers; inorganic chemicals such as acids and alkalis; agricultural chemicals such as fertilizers, pesticides and herbicides; and other categories such as industrial gases, specialty chemicals and pharmaceuticals. Various professionals are involved in the chemical industry including chemical engineers, chemists and lab technicians.			

Module 37

Code	Course/Module Title	ECTS	Semester
Che-317	Research methodology	2.00	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2/1	33	17
Description			
Discusses and explains the data collection and analysis methods you used in your research. A key part of your thesis, dissertation, or research paper, the methodology chapter explains what you did and how you did it, allowing readers to evaluate the reliability and validity of your research and your dissertation topic. It should include: The type of research you conducted. How you collected and analyzed your data Any tools or materials you used in the research. How you mitigated or avoided research biases. Why you chose these methods. Methodology section should generally be written in the past tense. Academic style guides in your field may provide detailed guidelines on what to include for different types of studies. Citation style might provide guidelines for your methodology section (e.g., an APA Style methods section).			

Module 38

Code	Course/Module Title	ECTS	Semester
Che-411	Instrumental analysis 1	6.00	7
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	71
Description			

Instrumental analysis is a field of analytical chemistry that investigates analytes using scientific instruments. Spectroscopy measures the interaction of the molecules with electromagnetic radiation. Spectroscopy consists of many different applications such as atomic absorption spectroscopy, atomic emission spectroscopy, ultraviolet-visible spectroscopy, X-ray fluorescence spectroscopy, infrared spectroscopy, Raman spectroscopy, nuclear magnetic resonance spectroscopy, photoemission spectroscopy, Mossbauer spectroscopy, and circular dichroism spectroscopy.

Module 39

Code	Course/Module Title	ECTS	Semester
Che-414	Identification 1	5.00	7
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	46
Description			
chemical identification as a process of setting up, testing, and screening of hypotheses, and review principles, techniques, and errors of identification. We also trace the relations between qualitative analysis and metrology and outline the range of known chemical compounds that are candidates for identification in general. We differentiate between methods for confirming identity and those for identifying unknowns, and discuss sources of prior data and new developments in reference data.			

Module 40

Code	Course/Module Title	ECTS	Semester
Che-417	Biochemistry 3	5.00	7
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	46
Description			
Biochemistry is the study of chemical processes within and relating to living organisms. A sub-discipline of both chemistry and biology, biochemistry may be divided into three fields: structural biology, enzymology, and metabolism. Over the last decades of the 20th century, biochemistry has become successful at explaining living processes through these three disciplines. Almost all areas of the life sciences are being uncovered and developed through biochemical methodology and research. Biochemistry focuses on understanding the chemical basis which allows biological molecules to give rise to the processes that occur within living cells and between cells, in turn relating greatly to the understanding of tissues and organs as well as organism structure and function. Biochemistry is closely related to molecular biology, the study of the molecular mechanisms of biological phenomena. Much of biochemistry deals with the structures, functions, and interactions of biological macromolecules such as proteins, nucleic acids, carbohydrates, and lipids. They provide the structure of cells and perform many of the functions associated with life. The chemistry of the cell also depends upon the reactions of small molecules and ions. These can be inorganic (for example, water and metal ions) or organic (for example, the amino acids, which are used to synthesize proteins). The mechanisms used by cells to harness energy from their environment via chemical reactions are known as metabolism. The findings of biochemistry are applied primarily in medicine, nutrition and agriculture. In medicine, biochemists investigate the causes and cures of diseases. Nutrition studies how to maintain health and wellness and also the effects of nutritional deficiencies.			

Module 41

Code	Course/Module Title	ECTS	Semester
Che-420	Industrial chemistry ³	6.00	7
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	78	72
Description			
The chemical industry study the companies and other organizations that develop and produce industrial, specialty and other chemicals. Central to the modern world economy, it converts raw materials (oil, natural gas, air, water, metals, and minerals) into commodity chemicals for industrial and consumer products. It includes industries for petrochemicals such as polymers for plastics and synthetic fibers; inorganic chemicals such as acids and alkalis; agricultural chemicals such as fertilizers, pesticides and herbicides; and other categories such as industrial gases, specialty chemicals and pharmaceuticals. Various professionals are involved in the chemical industry including chemical engineers, chemists and lab technicians.			

Module 42

Code	Course/Module Title	ECTS	Semester
Che-423	Spectroscopy chemistry	4.00	7
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0	48	52
Description			
Spectroscopy is the field of study that measures and interprets electromagnetic spectra. In narrower contexts, spectroscopy is the precise study of color as generalized from visible light to all bands of the electromagnetic spectrum. Spectroscopy, primarily in the electromagnetic spectrum, is a fundamental exploratory tool in the fields of astronomy, chemistry, materials science, and physics, allowing the composition, physical structure and electronic structure of matter to be investigated at the atomic, molecular and macro scale, and over astronomical distances			

Module 43

Code	Course/Module Title	ECTS	Semester
Che-426	Research project	4.00	7
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
0	0/2/0/0	33	67
Description			

All Internal Medicine residents are required to complete a research project during their residency. A research project is a scientific endeavor to answer a research question. Research projects may include: case series, case control study, cohort study, randomized, controlled trial, survey, and secondary data analysis such as decision analysis, cost effectiveness analysis or meta-analysis. Each resident must work under the guidance of a faculty mentor. Depending on your area of research interest or your research topic, you may be able to identify a mentor on your own, or if needed, you will be assigned one. You are also provided with a step-by-step guide to simplify the process and a suggested timeline for research project completion to ensure that you meet your requirement in a timely manner.

Module 44

Code	Course/Module Title	ECTS	Semester
Che-421	Instrumental analysis 2	6.00	8
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	71
Description			
Instrumental analysis is a field of analytical chemistry that investigates analytes using scientific instruments. Spectroscopy measures the interaction of the molecules with electromagnetic radiation. Spectroscopy consists of many different applications such as atomic absorption spectroscopy, atomic emission spectroscopy, ultraviolet-visible spectroscopy, X-ray fluorescence spectroscopy, infrared spectroscopy, Raman spectroscopy, nuclear magnetic resonance spectroscopy, photoemission spectroscopy, Mossbauer spectroscopy, and circular dichroism spectroscopy			

Module 45

Code	Course/Module Title	ECTS	Semester
Che-424	Identification 2	5.00	8
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	46
Description			
chemical identification as a process of setting up, testing, and screening of hypotheses, and review principles, techniques, and errors of identification. We also trace the relations between qualitative analysis and metrology and outline the range of known chemical compounds that are candidates for identification in general. We differentiate between methods for confirming identity and those for identifying unknowns, and discuss sources of prior data and new developments in reference data.			

Module 46

Code	Course/Module Title	ECTS	Semester
Che-427	Biochemistry 4	5.00	8
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	79	46
Description			

Biochemistry is the study of chemical processes within and relating to living organisms. A sub-discipline of both chemistry and biology, biochemistry may be divided into three fields: structural biology, enzymology, and metabolism. Over the last decades of the 20th century, biochemistry has become successful at explaining living processes through these three disciplines. Almost all areas of the life sciences are being uncovered and developed through biochemical methodology and research. Biochemistry focuses on understanding the chemical basis which allows biological molecules to give rise to the processes that occur within living cells and between cells, in turn relating greatly to the understanding of tissues and organs as well as organism structure and function. Biochemistry is closely related to molecular biology, the study of the molecular mechanisms of biological phenomena. Much of biochemistry deals with the structures, functions, and interactions of biological macromolecules such as proteins, nucleic acids, carbohydrates, and lipids. They provide the structure of cells and perform many of the functions associated with life. The chemistry of the cell also depends upon the reactions of small molecules and ions. These can be inorganic (for example, water and metal ions) or organic (for example, the amino acids, which are used to synthesize proteins). The mechanisms used by cells to harness energy from their environment via chemical reactions are known as metabolism. The findings of biochemistry are applied primarily in medicine, nutrition and agriculture. In medicine, biochemists investigate the causes and cures of diseases. Nutrition studies how to maintain health and wellness and also the effects of nutritional deficiencies.

Module 47

Code	Course/Module Title	ECTS	Semester
Che-430	Industrial chemistry4	6.00	8
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0/2/0/0	78	72
Description			
The chemical industry study the companies and other organizations that develop and produce industrial, specialty and other chemicals. Central to the modern world economy, it converts raw materials (oil, natural gas, air, water, metals, and minerals) into commodity chemicals for industrial and consumer products. It includes industries for petrochemicals such as polymers for plastics and synthetic fibers; inorganic chemicals such as acids and alkalis; agricultural chemicals such as fertilizers, pesticides and herbicides; and other categories such as industrial gases, specialty chemicals and pharmaceuticals. Various professionals are involved in the chemical industry including chemical engineers, chemists and lab technicians.			

Module 48

Code	Course/Module Title	ECTS	Semester
C Che-433he-430	Quantum chemistry	4.00	8
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0	48	52
Description			
Quantum chemistry, also called molecular quantum mechanics, is a branch of physical chemistry focused on the application of quantum mechanics to chemical systems, particularly towards the quantum-mechanical calculation of electronic contributions to physical and chemical properties of molecules, materials, and solutions at the atomic level. These calculations include systematically			

applied approximations intended to make calculations computationally feasible while still capturing as much information about important contributions to the computed wave functions as well as to observable properties such as structures, spectra, and thermodynamic properties. Quantum chemistry is also concerned with the computation of quantum effects on molecular dynamics and chemical kinetics. Chemists rely heavily on spectroscopy through which information regarding the quantization of energy on a molecular scale can be obtained. Common methods are infra-red (IR) spectroscopy, nuclear magnetic resonance (NMR) spectroscopy, and scanning probe microscopy. Quantum chemistry may be applied to the prediction and verification of spectroscopic data as well as other experimental data. Many quantum chemistry studies are focused on the electronic ground state and excited states of individual atoms and molecules as well as the study of reaction pathways and transition states that occur during chemical reactions. Spectroscopic properties may also be predicted. Typically, such studies assume the electronic wave function is adiabatically parameterized by the nuclear positions (i.e., the Born–Oppenheimer approximation). A wide variety of approaches are used, including semi-empirical methods, density functional theory, Hartree–Fock calculations, quantum Monte Carlo methods, and coupled cluster methods. Understanding electronic structure and molecular dynamics through the development of computational solutions to the Schrödinger equation is a central goal of quantum chemistry. Progress in the field depends on overcoming several challenges, including the need to increase the accuracy of the results for small molecular systems, and to also increase the size of large molecules that can be realistically subjected to computation, which is limited by scaling considerations the computation time increases as a power of the number of atoms.

Module 49

Code	Course/Module Title	ECTS	Semester
Che-436	selective 2	4.00	8
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	0	33	67
Description			
This class will be chosen by the department according to their need.			

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