King Khalid University

College of Science

chemistry department

جامعة الملك خالد

KING KHALID UNIVERSITY

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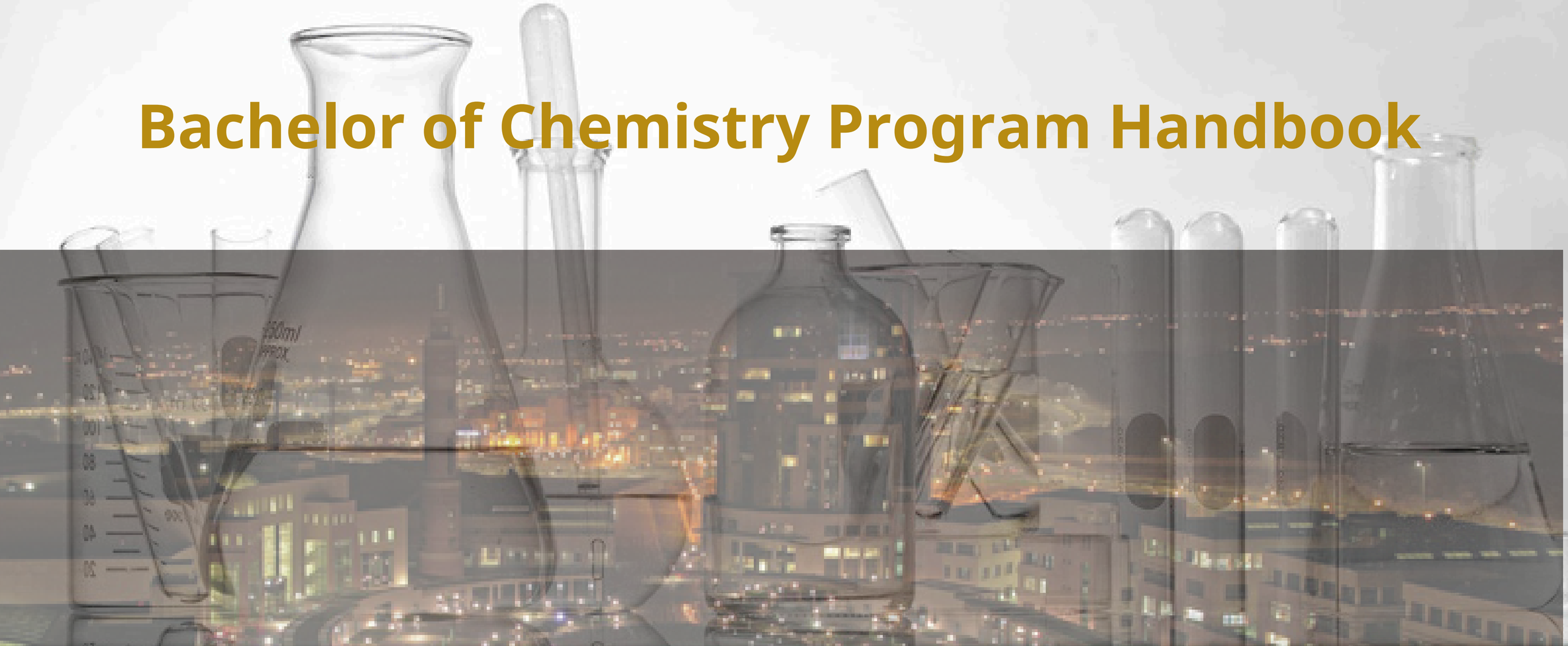
كلية العلوم

قسم الكيمياء

Bachelor of Chemistry Program Handbook



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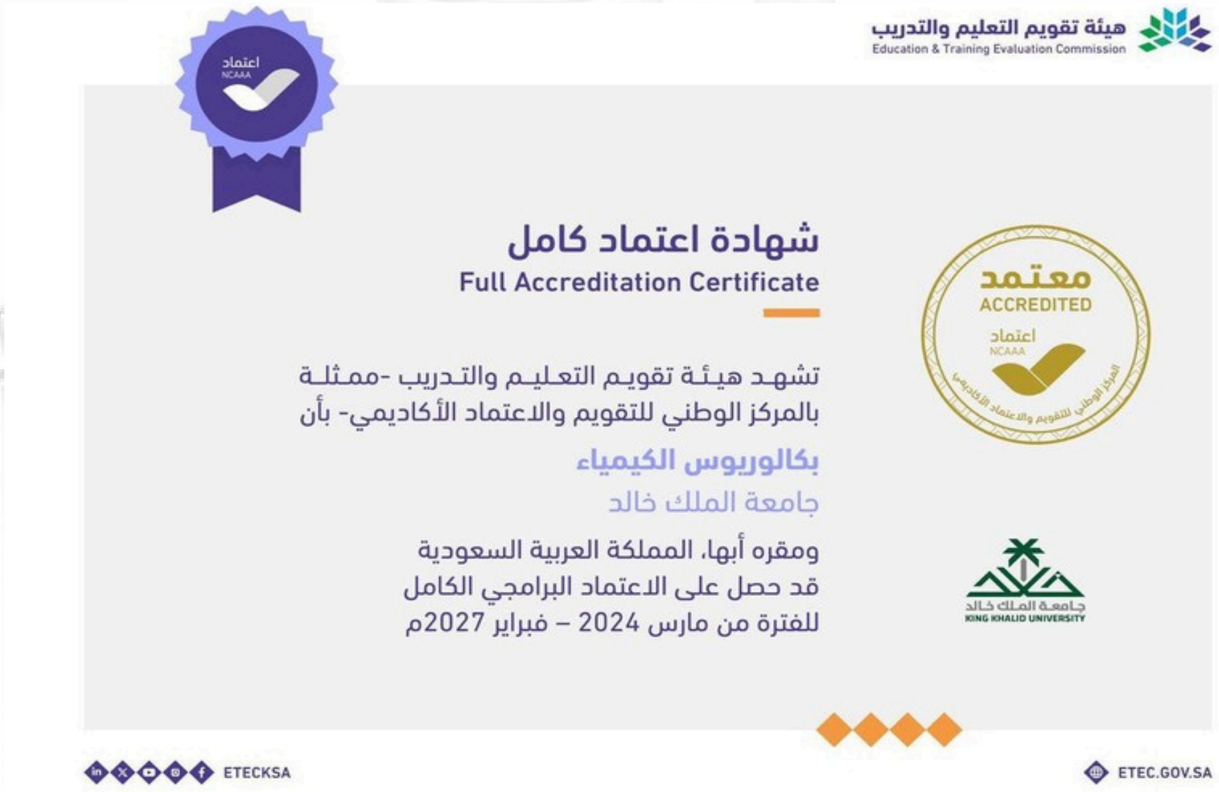

Full academic accreditation of the program:

The Bachelor of Science in Chemistry program has received full academic accreditation from the National Center for Academic Evaluation and Accreditation (NCAAA).

From February 2024 AD
to February 2027 AD.

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1- About the program

Program name: Bachelor of Science in Chemistry Program code: B.SC. in Chemistry Name of the degree that the student will obtain: Bachelor of Science in Chemistry

Career opportunities after graduation:

1- Teaching in pre-university education stages

2- Working in industrial fields related to chemistry.

3- Working in Saudi higher education institutions such as universities.

4- Working in research centers and public and private institutions that require chemistry skills.

2- Mission and objectives

Mission: Preparing graduates who are competitive in the labor market, and postgraduate studies and who contribute to serving the community.

Objectives:

1. **Preparing graduates who are competitive in the labor market**
2. **Qualifying chemists to continue in postgraduate programs.**
3. **Participation in community service and volunteer work.**

3- Learning outcomes

Values:

1. Demonstrate social responsibility and commitment to ethics in chemistry.
2. Work effectively, either independently or as a member of a team, to solve a problem.
3. Demonstrate effective oral and written scientific communication.
4. Retrieve relevant technical information from professional databases and search engines.

Skills:

1. Demonstrate problem-solving skills in chemistry.
2. Apply good research practices in chemistry and related fields.
3. Identify chemicals and equipment and their appropriate use, to conduct practical experiments while following safety procedures.
4. Critique and analyze chemical data for experimental results based on scientific literature.

Knowledge:

1. Understand the basic theories and concepts of chemistry.
2. Explore the fundamentals of mathematics, physics and biology related to chemical sciences.
3. Describe recent experimental results, developments and applications of chemistry in life.

4- Admission and graduation requirements

Admission requirements:

To be a Saudi national or have a Saudi mother.
Obtaining a national identity.
Not to have been dismissed academically or disciplinary from the university or any other Saudi university.
That no more than five years have passed since the date of receiving the high school certificate.

Graduation requirements:

To obtain a Bachelor of Science in Chemistry, one must complete 126 credit hours, equivalent to 157 actual credit hours, studied over four years, over eight semesters, with a GPA of no less than acceptable.

5- Description of the courses

1- General Chemistry-1 (101CHEM-4)

This course covers the basic principles and methods of chemistry, which are the foundation for all subsequent chemistry courses. The course covers the metric system, scientific notation and significant figures, chemical formulas, chemical reactions and the measurement of chemical reactions, the atom and atomic structure, principles of chemical equilibrium, and the fundamentals of organic chemistry. Weekly laboratory experiments emphasize qualitative techniques and complement the lecture material.

2- General Chemistry-2 (102CHEM-3)

This course is the second in a two-semester sequence in a comprehensive study of the chemical and physical properties of matter including the basic principles of qualitative and quantitative analysis. Topics include solutions, kinetics, equilibria, free energy, electrochemistry, and an introduction to specific areas of chemistry. The course is designed for science and other disciplines that require a comprehensive understanding of current content knowledge in basic chemistry. Two (2) lectures and one (1) two-hour laboratory period per week.

5- Description of the courses

3- Organic Chemistry 1 (212CHEM-4)

This course introduces the basic principles, nomenclature, and common applications of organic chemistry. It focuses on how chemical structure affects the properties and reactivity of organic molecules, i.e., saturated and unsaturated hydrocarbons, including aromatics. In addition, this course introduces the fundamentals of molecular geometry, polarity, conformation, isomerism, functional groups, stereochemistry, reactions of organic compounds, and their mechanisms.

4- Organic Chemistry 2 (213CHEM-4)

Organic Chemistry: Study of different types of functional organic compounds such as alcohols, phenols, ethers, thiols, thioethers, aldehydes, ketones, carboxylic acids and amines and their preparations and reactions.

5- Description of the courses

5- Chemistry of Main Group Elements (222CHEM-2)

This course focuses on the chemistry of the s- and p-block elements, the concepts of structure and bonding, and a systematic understanding of their chemical reactions. Each group will be maintained separately, with an emphasis on the chemistry of some of the elements in the group (their compounds, chemical properties, reactions, and applications).

6- Chemical Thermodynamics (232CHEM-2)

The primary goal of chemical thermodynamics is to provide a physical explanation of the fundamental principles governing a variety of chemical phenomena that occur in the world around us. The goal of this course is to provide students with a conceptual understanding of the main principles of the laws of thermodynamics. Topics include: the concept of work, internal energy, enthalpy, entropy; the Clausius Gibbs definition of entropy; entropy and information; spontaneous and non-spontaneous processes; the thermodynamics of chemical reactions and the Carnot cycle as applied to energy changes.

5- Description of the courses

7- Electrochemistry (233CHEM-3)

The electrochemistry course introduces the student to the fundamentals of electrochemical reactions and the basic thermodynamics of oxidation-reduction reactions, with emphasis on galvanic and electrolytic cells and their applications such as batteries, electroplating, electrolysis, and metal refining. This course also covers the fundamentals of electronic and ionic electrical conduction and applications of electrical conduction.

8- Qualitative Analysis (241CHEM-2)

This course focuses on the various terminologies related to qualitative analysis to develop a better understanding of the field. Various topics such as the effect of common ions, solubility products, equilibrium constant, and buffer solutions will be comprehensively covered. General methods of qualitative analysis will be covered.

5- Description of the courses

9- Quantitative Analysis-1 (242CHEM-3)

Analytical chemistry includes two types; quantitative analysis and qualitative analysis. Quantitative analysis is the core of this course. Generally, there are two methods; classical methods and modern methods. Classical methods are dominant in this course. Classical methods include gravimetric analysis and volumetric analysis. These two classical methods will be covered comprehensively in this course. Volumetric titration is acid-base titration, complexation titration, precipitation titration, and redox titration. In addition, analytical chemistry statistics and principles of analytical chemistry will also be covered.

10- Qualitative Analysis (241CHEM-2)

This course focuses on the various terminologies related to qualitative analysis to develop a better understanding of the field. Various topics such as the effect of common ions, solubility products, equilibrium constant, and buffer solutions will be comprehensively covered. General methods of qualitative analysis will be covered.

5- Description of the courses

11- Organic Chemistry 3 (313CHEM-2)

This course aims to explain the nomenclature, methods of preparation, and physical and chemical properties of bifunctional organic compounds.

12- Spectral analysis of organic compounds (314CHEM-2)

This course covers the identification of organic compounds using various spectroscopic techniques such as ultraviolet-visible (UV-Vis), infrared (IR), nuclear magnetic resonance (1H, 13C-NMR), and mass spectrometry (MS).

13- Industrial Chemistry (315CHEM-2)

In this course, the student studies three types of industry: petrochemicals, polymers, and dyes, their preparations and uses.

5- Description of the courses

14- Chemistry of Transition Elements (323CHEM-4)

This course is the second of three semesters in a comprehensive study of this course aimed at studying the chemistry of the transition elements with the lanthanides and actinides and their uses. Emphasis will be placed on coordination chemistry and theories that explain bonding in complex formation and their applications in biological systems. The course is designed for science and other disciplines that require a comprehensive understanding of current content knowledge in transition element chemistry. Three (3) lectures and (1) two-hour laboratory period per week.

5- Description of the courses

15- Nuclear and Radiological Chemistry (324CHEM-2)

Definition of vocabulary - Nature of nuclear and radioactive chemistry. Basic properties of the nucleus - Nuclear species Most differences between nuclear and chemical reaction equations. Standards of atomic masses and binding energy and how to calculate the radius of the nucleus and how to calculate the nuclear Coulomb barrier and how to calculate nuclear forces and nuclear stability. Radioactive decay - Sources of radiation Types of radiation (alpha, beta, gamma): Energies Spectra of radioactive decay chains. Detection of radioactivity - Gas counters - Relative counter - Geiger counter - Muller counter - Scintillation counters - Transuranium elements.

Nuclear reactions and their types: nuclear fission - nuclear fusion energy releases - types of nuclear reactions according to their energies - elasticity of dispersion - low-energy reactions - high-energy reactions.

Uranium enrichment – Types of nuclear reactors – Breeder reactor – Graphite reactor – Uranium reactors – Heavy water – Materials testing reactors – Swimming pool reactors. Biological effects of radiation and protection factors – Control of radiation exposure effects – Stages of radiation effects. Radiation effects – Equivalent dose – Radiation dosimetry and units of measurement – Relative biological effect (RBE) – Applications of different isotopes in industry, agriculture, medicine and chemistry (analytical and organic). Lanthanides and actinides are the reason for their name, electronic configuration, uses and physical and chemical properties.

5- Description of the courses

16- Solid State Chemistry (325CHEM-2)

The course deals with the study of solid state chemistry of pure crystalline materials. This course aims to introduce the crystal structure, crystal systems, crystal symmetry and types of crystalline solids. In addition to using X-rays to identify the crystal structure as well as identifying crystal defects and semiconductors and their practical applications. This course also provides a brief introduction to the cement industry.

17- Surface Chemistry, Catalysis and Phase Rule (335CHEM-3)- Surface Chemistry, Catalysis and Phase Rule (335CHEM-3)

The current course presents four main topics: surface chemistry, catalysis, colloid chemistry, and phase equilibrium chemistry. In general, the course discusses the following topics: surface structure, adsorption behavior, physical properties of surfaces, homogeneous catalysis, heterogeneous catalysis, enzymatic catalysis, colloid preparation and purification techniques, applications of colloids and finally, phase equilibrium in a single-phase system such as water and sulfur.

5- Description of the courses

18- Kinetics and Reaction Mechanism (336CHEM-4)

This course provides students with experimental and theoretical knowledge of the kinetics and mechanisms of chemical reactions. It aims to introduce students to the basic principles and concepts of reaction rate, factors affecting reaction rate, rate law, activation energy, zero differential rate laws, first and second order reactions, and half-lives of reactions. It also discusses the kinetics and mechanisms of basic and complex reactions by implementing the steady state approximation and rate determination step.

19- Environmental Analysis (341CHEM-2)

The course describes the main components of the environment (air, water and soil) and focuses on different environmental problems to develop a better understanding of pollution problems as well as an overview of the main chemical analysis of air, water and soil.

20- Instrumental Analysis 1 (342CHEM-2)

The course describes various machine techniques, theoretical aspects, instrumentation, and applications.

5- Description of the courses

21- Identifying Organic Compounds (362CHEM-2)

This course aims to provide the student with good knowledge to study different types of aliphatic and aromatic compounds as well as to identify the types of organic compounds S1, S2, A1, A2, N1 and N2 using their confirmatory chemical reactions. Students will also be trained to detect heteroatoms (nitrogen and sulfur) and halogens. They will also acquire skills in handling sensitive chemicals. Students are also taught the knowledge necessary to separate different types of organic mixtures.

22- Quantitative Organic Analysis (363CHEM-2)

This course introduces the basic principles of analytical determination of organic functional groups in various compounds using quantitative assays (direct titration, volumetric or gravimetric analysis, etc.).

5- Description of the courses

23- Mechanism of Organic Reactions (416CHEM-2)

The aim of this course is to provide basic knowledge and concept of organic reaction mechanisms, such as nucleophilic substitution reactions, SN1, SN2 and their reaction mechanisms, and elimination of organic substances.

Reactions, E1, E2 and their reaction mechanisms, Electrophilic addition reactions to C=C and their reaction mechanisms, Nucleophilic addition reactions to C=O and their reaction mechanisms. Train students on how to identify the type of reaction and its mechanism and discuss it.

24- Heterocyclic Chemistry (417CHEM-2)

This course is designed to cover the basic principles of some classes of heterocyclic organic compounds, including nomenclature, synthesis, reactions, and their applications.

5- Description of the courses

25- Organometallic Chemistry (418CHEM-2)

This course covers the properties, structures, chemical reactivity and applications of organometallic compounds based on primary and transition metals. The uses of organometallic compounds as catalysts in oxidation-reduction and coupling reactions are also discussed.

26- Natural Products (419CHEM-2)

Distinguish between primary and secondary metabolites and their biological roles. Structural characteristics of the major classes of natural products and identification of biological building blocks and chemical synthesis. Study of the biological activity of natural products and their role in the pharmaceutical industry. The chemistry underlying methods of extraction and isolation of natural products.

5- Description of the courses

27- Inorganic and Organometallic Chemistry (425CHEM-2)

Spectroscopic studies and characterization of molecular structures of complexes in the visible, ultraviolet, infrared, nuclear magnetic resonance and magnetic regions. Studies the properties of organometallic complexes of transition metals as homogeneous and heterogeneous catalysts in important chemical reactions. This course is intended for science and other disciplines.

28- Mechanism of Inorganic Reactions (426CHEM-2)

The course provides students with the basic knowledge and principles of inorganic reaction pathways, rate constants and mechanisms of fast and slow reactions. It also focuses on the formation of inorganic aqueous ionic complexes, stepwise complex formation, factors affecting the stability of complexes, ligand substitution reactions, theories of inorganic reaction mechanisms, formal kinetics and rate laws. Kinetics and mechanism of redox reactions in inorganic complexes, inner and outer field reactions. Ligand interactions and mechanisms of reactions of organic and inorganic metal systems.

5- Description of the courses

29- Corrosion (435CHEM-3)

This course is designed to introduce the definition and basic concepts of corrosion, types of corrosion, direct and indirect cost of corrosion. This course also aims to list and identify different types of corrosion cells. This course also aims to apply different methods of measuring corrosion rate. The course provides basic knowledge of thermodynamics and kinetics of corrosion and highlights the main methods of corrosion prevention.

30- Quantum Chemistry (436CHEM-2)

This course introduces the basic principles of quantum chemistry and its applications in describing atoms and molecules, their interactions with other molecular systems, and electromagnetic radiation.

31- Biochemistry (450BCH-3)

The course is divided into two sections: chemistry and functions of biomolecules, their digestion and absorption, and general metabolic pathways as well as metabolism of glucose, fatty acids and the amino group of amino acids.

5- Description of the courses

32- Organic Preparations (464CHEM-2)

This course presents the basic principles of preparation of some organic compounds, study of the physical and chemical properties of the prepared compounds, calculation of the theoretical and practical yield compared to the yield, calculation of the percentage yield, and an attempt to prove the structures of these compounds using different spectral data if possible.

33- Instrumental Analysis-2 (465CHEM-2)

This course applies various types of instrumental analysis including molecular spectroscopy, atomic absorption spectroscopy (AAS), atomic emission spectroscopy (AES), thin layer chromatography (TLC), gas chromatography (GC), high performance liquid chromatography (HPLC), pH measurement, conductivity titration, and potentiometric titration.

5- Description of the courses

34- Inorganic Chemistry (466CHEM-2)

Preparation of some inorganic compounds. Study of the physical and chemical properties of the prepared compounds. Writing a scientific report summarizing the results obtained during the experiment. Trying to interpret these results and compare the practical results with the theoretical results. This report is submitted within a week of the experiment. Applying the principle of cooperative learning. Working effectively either within a team or independently in solving problems. Communicating effectively with his teacher and colleagues.

35- Physical Chemistry (467CHEM-3)

Study of different experiments in physical chemistry.

36- Research Project (470CHEM-3)

This course highlights the principles of research methodology and ethics, as well as the research process from adopting a research problem to preparing reports. Students carry out a small research project under the close supervision of a faculty member.

6- Characteristics of graduates

1- Qualified graduates in chemistry who are responsible and civic-minded towards society.

2- Graduates who are aware of the basic theories and principles and possess basic practical skills in chemistry.

3- Graduates who have the skill to obtain the required information in the field of chemistry, use chemical analysis devices, and analyze and interpret practical results.

4- Graduates who are qualified to explain chemistry topics easily and have skills in scientific communication and collaborative work.

7- Study plan

Click here to view the curriculum for the Bachelor of Science in Chemistry

The concept of credit and actual hours:

Actual hours are the hours that the student studies, while credit hours are the hours that are included in the cumulative average.

Credit hour system: It is a university study program followed in many countries of the world in European and American universities. The credit hour is a unit of measurement for the courses that the student must study in the semester or in the entire year for each subject, such that each subject has an equivalent number of hours. The number of credit hours varies according to the college or university, and there is a minimum and maximum number of hours that the student can attend per week.

8- Contact us

1- Head of Chemistry Department:
Dr. Saleh S. Alarfaji

ssalarvagi@kku.edu.sa
Phone number: +966–17–241–7773

2- Vice Head of Chemistry Department:
Dr. Afaf Yahya Khurmi

Email: aalkormi@kku.edu.sa
Phone number: +966–17–241–2813

Postal Address: Department of Chemistry, College of Science, King Khalid University P.O. Box: 960,
Postal Code: 61421 Abha -
Kingdom of Saudi Arabia