DEPARTMENT OF CHEMISTRY
Shri Lal Bahadur Shastri Degree College
Gonda

Bachelor of Science (B.Sc.) Chemistry

Program's Outcomes

Bachelor of Science in chemistry is a three-year degree program in which students will have precise insight into: -

- Fundamentals and application of current chemical and scientific theories in analytical, inorganic, organic, and physical chemistry.
- Designing and performing scientific experiments, data curation, and analysis.
- Problem-solving, critical thinking, and analytical reasoning for scientific problems.
- New areas of research in both chemistry and allied fields of science and technology.
- Central role of chemistry in our society including an understanding of safe handling of chemicals, environmental issues, and key issues facing our society in energy, health, and medicine.
- Potential of chemistry for addressing social, economic, and environmental problems.

Program Specific Outcomes

B.Sc. I-Year

(Certificate in Bioorganic and Medicinal Chemistry)

This certificate course will give an insight into all the branches of chemistry and enable students to join the knowledge and available opportunities related to chemistry in the government and private sector services particularly in the field of food safety, health inspector, pharmacist, etc. After the completion of the course, the students will have a precise understanding of -

- Fundamental principles of chemistry like periodic properties, molecular polarity, and theories of bonding.
- Stereochemistry, and mechanism of organic Reactions.
- Basic mathematical concepts and computer knowledge.
- Chemistry of carbohydrates, proteins, and nucleic acids, medicinal chemistry, synthetic polymers, and synthetic dyes.
- Qualitative quantitative and biochemical analysis of the compounds in the laboratory.

B.Sc. II-Year

(Diploma in Chemical Dynamics and Analytical Techniques)

Diploma in Chemical Dynamics and Analytical Techniques will make the students skilled to work in industries, especially in chemical industries like cement industries, agro product, paint industries, rubber industries, petrochemical industries, food processing industries, fertilizer industries, pollution monitoring, and control agencies, etc. It will provide theoretical as well as practical knowledge of handling chemicals, apparatus, equipment, and instruments. It introduces the student to various aspects like-

- The knowledge about feasibility and velocity of chemical reactions through chemical kinetics, chemical equilibrium, phase equilibrium, and kinetic theories of gases, solid, and liquid states.
- Introduction to coordination chemistry, metal carbonyls, and bioinorganic will enable the students to work as chemists in the pharmaceutical industries.
- The knowledge about atomic structure, quantum mechanics, various spectroscopic tools, and separation techniques.

- The laboratory skills and safe measurements to transfer and interpret knowledge entirely in the working environment.

B.Sc. III-Year

(Degree in Bachelor of Science)

Upon completion of a degree, chemistry students are able to employ critical thinking and scientific inquiry in the performance, design, interpretation, and documentation of laboratory experiments, at a level suitable to succeed at an entry-level position in the chemical industry or a chemistry graduate program. Degree in Bachelor of Science programme aims to-

- Introduce very important aspects of the modern-day course curriculum, namely, the chemistry of hydrocarbons, alcohols, carbonyl compounds, carboxylic acids, phenols, amines, heterocyclic compounds, and natural products.
- To study the main group elements, qualitative analysis, separation techniques, and analytical techniques.
- To understand the importance of the elements in the periodic table including their physical, and chemical nature and role in daily life.
- To understand the concept of chemistry to interrelate and interact with the other subject like mathematics, physics, biological science, etc. ·

Course Outcome

Semester-1, Paper-1 (Theory)

Course Title: Fundamentals of Chemistry

Students admitted to B.Sc. chemistry semester-1 program will gain precise insight into the:

- Molecular geometries, physical and chemical properties of the molecules.
- Current bonding models for simple inorganic and organic molecules in order to predict structures and important bonding parameters.
- Basics of organic chemistry, reactive intermediates, transition states, bond breaking, and bond formation.
- Theoretical picture in multiple stages in an overall chemical reaction.
- Understanding the reactants, catalyst, stereochemistry, and major and minor products of any organic reaction.
- Kinetic and thermodynamic aspects of reaction and the ways how the reaction mechanism can be determined.
- Stereochemistry, and their role in reaction mechanism.

Semester-1, Paper-2 (Practical)

Course Title: Quantitative Analysis

Upon the completion of this course the students will have the knowledge and skills to understand the laboratory methods and tests related to-

- Estimation of metals ions and estimation of acids and alkali contents in commercial products.
- Potability tests of water samples.

- Estimation of metal ions in samples.
- Estimation of alkali and acid contents in samples.
- Estimation of inorganic salts and hydrated water in samples.

Semester-2, Paper-1 (Theory)

Course Title: Bioorganic and Medicinal Chemistry

Biomolecules are important for the functioning of living organisms. These molecules perform or trigger important biochemical reactions in living organisms. When studying biomolecules, one can understand the physiological function that regulates the proper growth and development of a human body. This course aims to introduce the students with-

- Basic understanding of carbohydrates, amino acids, proteins, and nucleic acids.
- Introduction to medicinal chemistry.
- Understanding the space lattice, crystallography, X-ray diffraction of crystals, crystal structure of some common salts.
- Introduction to polymers, inorganic and organic polymers and their kinetics.
- Introduction to natural and synthetic dyes and their applications.

Semester-2, Paper-2 (Practical)

Course Title: Biochemical Analysis

This course will provide basic of -

- Qualitative and quantitative experimental knowledge of biomolecules such as carbohydrates, proteins, amino acids, nucleic acids, and drug molecules.
- Demonstration of separation techniques like thin layer and paper chromatography.

- Extraction of protein, nucleic acids, and synthesis of simple drugs, and osazones.

Semester-3, Paper-1 (Theory)

Course Title: Chemical Dynamics & Coordination Chemistry

Upon successful completion of this course, students will be able to describe-

- Characteristic of the three states of matter.
- The different physical properties of each state of matter.
- Kinetic theory of gases, laws of crystallography, liquid state and liquid crystals.
- Conductometric, potentiometric, optical methods, polarimetry, and spectrophotometer.
- Chemical kinetics and chemical equilibrium.
- Metal- ligand bonding in transition metal complexes, thermodynamic and kinetic aspects of metal complexes.

Semester-3, Paper-2 (practical)

Course Title: Physical Analysis

Upon successful completion of this course, students should be able-

- To calibrate apparatus.
- Prepare solutions of various concentrations.
- Estimation of components through volumetric analysis.
- To perform dilatometric experiments: one and two component phase equilibrium experiments.

Semester-4, Paper-1 (Theory)

Course Title: Quantum Mechanics and Analytical Techniques

Students will be able to explore new areas of research in both chemistry and allied fields of science and technology. Students will be able to function as a member of an interdisciplinary problem-solving team. Students will be skilled in problem-solving, critical thinking and analytical reasoning as applied to scientific problems. Students will gain an understanding of-

- Atomic structure, elementary quantum mechanics, wave function and its significance comprising Schrodinger wave equation and its applications, and Molecular orbital theory.
- Molecular Spectroscopy, Rotational Spectrum, vibrational Electronic Spectrum, mass spectrometry, ^{1}H-NMR technique.
- To develop basic skills required for purification, solvent extraction, TLC and column chromatography.
- Determination of the structure of organic molecules using IR and NMR spectroscopic techniques.

Semester-4, Paper-2 (Practical)

Course Title: Instrumental Analysis

Upon completion of this course, chemistry majors are able to employ critical thinking and scientific inquiry in the performance, design, interpretation and documentation of laboratory experiments, at a level suitable to succeed at an entry-level position in chemical industry or a chemistry graduate program.

- Students will be skilled in problem-solving, critical thinking and analytical reasoning as applied to scientific problem.
- Students will gain an understanding of how to determine the structure of organic molecules using IR and NMR spectroscopic techniques.
- To develop basic skills required for purification, solvent extraction, TLC and column chromatography.

Semester-5, Paper-1 (Theory)

Course Title: Organic Synthesis A

This course will provide a broad foundation for the synthesis of hydrocarbons, hydroxyl and carbonyl compounds. Students will gain an understanding of selecting solvents and raw material for synthesis of drug and other pharmaceutically important compounds. The course will provide firm knowledge about-

- Synthesis and chemical properties of aliphatic and aromatic hydrocarbons.
- Synthesis and chemical properties of alcohols, phenols, halides, ethers, carbonyl compounds, carboxylic acids and esters.
- How to design and synthesize aliphatic and aromatic hydrocarbons.
- How to convert aliphatic and aromatic hydrocarbons to other industrially important compounds, functional group interconversion.

Semester-5, Paper-2 (Theory)

Course Title: Rearrangements and Chemistry of Group Elements

This paper provides detailed knowledge of synthesis of various class of organic compounds and functional groups inter conversion. Organic synthesis is the most important branch of organic chemistry which provides jobs in production & QC departments related to chemicals, drugs, medicines, FMCG etc. industries.

- It relates and gives an analytical aptitude for synthesizing various industrially important compounds.
- This paper also provides a detailed knowledge on the elements present in our surroundings, their occurrence in nature. Their position in periodic table, their physical and chemical properties as well as their extraction.
- This paper also gives detailed understanding of the s, p, d and f block elements and their characteristics.
- Discuss the homogeneous and heterogeneous catalysis including their industrial application.
- Discuss the enzymatic reactions and their kinetics.
- Introduce some important organic rearrangement reactions.

Semester-5, Paper-3 (Practical)

Course Title: Qualitative Analysis

Upon completion of this course the students will have the knowledge and skills to understand the laboratory methods and tests related to inorganic mixtures and organic compounds.

- Identification of acidic and basic radicals in inorganic mixtures.
- Separation of organic compounds from mixture.

- Elemental analysis in organic compounds.
- Identification of functional group in organic compounds.
- Identification of organic compound.

Semester-6, Paper-1 (Theory)

Course Title: Organic Synthesis B

This paper provides detailed knowledge of synthesis of various class of organic compounds and functional groups inter conversion. Organic synthesis is the most important branch of organic chemistry which provides jobs in production & QC departments related to chemicals, drugs, medicines, FMCG etc. industries. The study of natural products and heterocyclic compounds offers an excellent strategy toward identifying novel biological probes for a number of diseases. Historically, natural products have played an important role in the development of pharmaceutical drugs for a number of diseases including cancer and infection.

- It relates and gives an analytical aptitude for synthesizing various industrially important compounds.
- Learn the different types of alkaloids, & terpenes etc and their chemistry and medicinal importance.
- Explain the importance of natural compounds as lead molecules for new drug discovery.
- Discuss the reagents in organic synthesis and organometallic compounds.
- Study of different organic compounds comprising carboxylic acids, aldehydes, ketones, and nitrogen containing compounds.
- Study of heterocyclic compounds, their synthesis and application.

Semester-6, Paper-2 (Theory)

Course Title: Chemical Energetics and Radio Chemistry

Upon successful completion of this course students should be able to describe-

- laws of thermodynamics and its applications.
- phase equilibria of one and two component system.
- electro chemistry, ionic equilibrium applications of conductivity and potentiometric measurements.
- Colligative properties of ideal and non–ideal solutions and related thermodynamic derivations.
- Physical and chemical adsorption, adsorption isotherms, heterogeneous catalysis, colloids and their properties.
- Natural and induced radioactivity, measurement of radioactivity and radiochemistry.

Semester-6, Paper-3 (Practical)

Course Title: Analytical methods

Upon successful completion of this course students should be able to

- Quantify the product obtained through Gravimetric method.
- Determine R_f values and identify the organic compounds through paper and thin layer chromatography.
- Perform thermochemical reactions and relevant Laboratory techniques.