

Program Outcomes and Course Outcomes

Under Graduate program In B.Sc Chemistry

Program outcome

- To understand the basic facts and concepts in Chemistry
- To understand the importance of Chemistry in daily life.
- To develop a better understanding and reasoning of facts.
- To skill-up for basic analytical tools.
- To skill-up for various laboratory techniques used in pharmaceutical laboratories and chemical industries.
- To make efficient for various spectrometric analyses

Course Outcome

SEM-I

CHE-HC-1014: INORGANIC CHEMISTRY-I

- To give theoretical understanding about the basic constituents of matter – atoms, ions and molecules in terms of their electronic structure and reactivity.
- To develop a quantum chemistry concept on Structure and bonding.
- To introduce a concept of reactivity of chemical species based on their electron transfer affinity.
- To have an idea on periodic classification of elements in the periodic table and changes in properties along the periods.
- Accompanying laboratory course is designed to have hands-on experience of basic quantitative analytical techniques related to volumetric titrations.

CHE-HC-1024: PHYSICAL CHEMISTRY I

In gaseous state unit the students will learn the kinetic theory of gases, ideal gas and real gases. In liquid state unit, the students are expected to learn the qualitative treatment of the structure of liquid along with the physical properties of liquid, viz, vapour pressure, surface tension and viscosity. In the molecular and crystal symmetry unit they will be introduced to the elementary idea of symmetry which will be useful to understand solid state chemistry and group theory in some higher courses. In solid state unit the students will learn the basic solid state chemistry application of x-ray crystallography for the determination of some very

simple crystal structures. The students will also learn another important topic “ionic equilibria” in this course.

SEM-II

CHE-HC-2014: ORGANIC CHEMISTRY I

This course is inducted to apprise students with introduction to organic compounds, electron displacement, type of reagents and reaction intermediates. The chemistry of aliphatic and aromatic hydrocarbon, conformational analysis of cycloalkanes and basic stereochemical phenomena are included. Students are expected to learn different classes, learn, explain, describe and analyze different classes of organic compounds, their reactivities and mechanisms along with stereochemical considerations.

CHE-HC-2024: PHYSICAL CHEMISTRY II

In this course the chemical thermodynamics, chemical equilibrium, solutions and colligative properties will be taught to the students. Another unit of this course is systems of variable compositions. In this course the students are expected to learn laws of thermodynamics, thermochemistry, thermodynamic functions, relations between thermodynamic properties, Gibbs Helmholtz equation, Maxwell relations etc. Moreover the students are expected to learn partial molar quantities, chemical equilibrium, solutions and colligative properties. After completion of this course, the students will be able to understand the chemical systems from thermodynamic point of view.

Semester III

CHE-HC-3014: INORGANIC CHEMISTRY-II

- To give idea on the basic principles of metallurgy so as to acquaint the students with the application of the redox chemistry they have learnt in the earlier course on inorganic chemistry.
- To develop concepts of protonic and non-protonic acids and bases are introduced for students to appreciate different types of chemical reactions.
- To acquaint students with Periodic behavior of s and p block elements related to their electronic structure and their reactivity is included the principles governing their reactivity.
- To apprise students about the variety of compounds of the main group elements including oxides, hydrides, nitrides, interhalogens, noble gases and inorganic polymers.
- As part of the accompanying lab course, experiments involving iodo- and iodometric titrations are included for the students to explore other varieties of redox titration. Preparation of simple inorganic compounds is introduced to give hands-on experience of inorganic synthesis.

CHE-HC-3024: ORGANIC CHEMISTRY-II

This course is intended to apprise students about different classes of organic compounds, including halogenated hydrocarbons, alcohols, phenols, epoxides, carbonyl compounds and carboxylic and sulfonic acids. Students are expected to learn and differentiate between various organic functional groups; explain, analyze and design transformations between different functional groups.

CHE-HC-3034: PHYSICAL CHEMISTRY III

The aim of this course is to teach students four important topics of physical chemistry- phase equilibria, chemical kinetics, surface chemistry and catalysis. Phase equilibria and chemical kinetics will be discussed in detail but surface chemistry and catalysis will be introduced to the students.

Semester IV
-----**CHE-HC-4014: INORGANIC CHEMISTRY-III**

- To give basic idea of coordination chemistry. Various aspects like nomenclature, structure, bonding, variety and reactivity of the coordination compounds are included for the students to appreciate.
- To acquaint students on the useful and harmful aspects of metals in biological systems. Through the accompanying lab course, experiments related to gravimetric analysis, synthesis of coordination compounds and separation of metal ions using chromatography is included. This will provide various aspects of experiment design depending upon the requirements like synthesis, estimation or separation.

CHE-HC-4024: ORGANIC CHEMISTRY-III

The course introduces students to different classes of N-based compounds, including alkaloids and terpenoids and their potential application. Students are expected to learn about different classes of N-based compounds; their structures, synthesis and reactivity.

CHE-HC-4034: PHYSICAL CHEMISTRY-III

The aim of this course is to introduce students with primarily two areas of physical chemistry- electrochemistry and electrical and magnetic properties of atoms and molecules. It contains three units- conductance, electrochemistry and electrical & magnetic properties of atoms and molecules.

Semester V

CHE-HC-5014: ORGANIC CHEMISTRY-IV

This course introduces students to nucleic acids, amino acids and pharmaceutical compounds. Students will be familiarized with the importance of nucleic acids, amino acids and develop basic understanding of enzymes, bioenergetics and pharmaceutical compounds.

CHE-HC-5024: PHYSICAL CHEMISTRY V

The aim of this course is to introduce the students with three important areas- quantum chemistry, molecular spectroscopy and photochemistry. In quantum chemistry unit the students will be taught the postulates of quantum mechanics and the application of quantum mechanical ideas in some simple systems such as particle in a box, rigid rotor, simple harmonic oscillator etc. In spectroscopy unit, rotational, vibrational, Raman, electronic, spin resonance, and electronic spectroscopy will be introduced.

CHE-HE-5024: ANALYTICAL METHODS IN CHEMISTRY

- To learn more about the qualitative/quantitative characterization and separation techniques. The content of this course aims to cover some of the widely used instrumental techniques for characterization of samples.
- Experiments included aim at giving students hands on experience using different instrumental techniques and chemical analysis.
- Through the experiments students will gain hands on experience of the discussed techniques. This will enable students to take judicious decisions while analyzing different samples.

CHE-HE-5044: NOVEL INORGANIC SOLIDS

- To make learners familiar with a wide variety of technologically important and emerging materials. It will prepare the learners for studying materials further at the master's level.
- After the completion of this course it will also be possible for the students to opt for studying an interdisciplinary master's programme with an emphasis on the synthesis and applications of various materials or take up a job in the materials production and/or processing industry.

CHE-HE-5064: INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

- To introduce to the fundamental concepts/theory and application of different analytical techniques, as applied to chemistry.
- To explain the theoretical basis of different analytical techniques, identify the experimental requirements and compare/analyze the data/results thereof.

Semester VI
-----**CHE-HC-6014: INORGANIC CHEMISTRY-IV**

The unit on reaction mechanism is included for the students to get acquainted with the kinetic and thermodynamic factors governing the reaction path and stability of inorganic compounds. Organometallic compounds are introduced so as to apprise students about the importance of metal carbon bond to form complexes and their application as catalysts. Students are expected to learn factors leading to stability of organometallic compounds, their synthesis, reactivity and uses. Qualitative inorganic analysis is included to give students an idea and hands on experience of application of inorganic chemistry. Students should learn how differential reactivity under different conditions of pH can be used to identify variety of ions in a complex mixture. Experiments related to synthesis and characterizations of coordination compounds are included to supplement their theoretical knowledge.

CHE-HC-6024: ORGANIC CHEMISTRY-V

This is a basic course in organic spectroscopy and provides introduction to carbohydrate chemistry, dyes and polymers. Students are expected to learn about the different spectroscopic techniques and their applications in organic chemistry. Students shall be apprised with carbohydrate chemistry, dyes and polymers and their structure, reactivity and chemical properties.

CHE-HE-6014: GREEN CHEMISTRY

- To give an idea about the emerging discipline of green chemistry.
- To differentiate as to how the principles of green chemistry may be applied to organic synthesis.
- This course will make them conversant with applications of green chemistry to organic synthesis. Students will be prepared for taking up entry level jobs in the chemical industry.

CHE-HE-6024: INDUSTRIAL CHEMICALS AND ENVIRONMENT

- To provides an introduction to the various industrial gases and inorganic chemicals, their manufacturing processes, applications, storage and the hazards of handling them.
- To learn about metallurgy, energy generation industry and the pollution threat they pose. This course also discusses about management of the different kinds of wastes, their safe disposal and the importance of practicing green chemistry in chemical industry.
- Students will have learnt about the manufacture, applications and safe ways of storage and handling gaseous and inorganic industrial chemicals. Students will get to know about

industrial metallurgy and the energy generation industry. Students will also learn about environmental pollution by various gaseous, liquid wastes and nuclear wastes and their effects on living beings.

- Students will learn about industrial waste management, their safe disposal and the importance of environment friendly “green chemistry” in chemical industry.

CHE-HE-6034: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

- To learn the synthetic process, properties and the utility of the industrially important inorganic materials (such as silicates, ceramics, cements, fertilizers, paints, batteries, alloys and explosives).
- To provide opportunity to learn some of the industrial process such as surface coating and catalysis in relevant to industry where heterogeneous catalysis dominates.
- To acquire hands on experience in qualitative and quantitative analysis of the inorganic materials which are basically manufactured in chemical industries.
- To give basic foundation of industrial inorganic chemistry among the students. This will be helpful for pursuing further studies of industrial chemistry in future. Experiments will help the Students to gather the experience of qualitative and quantitative chemical analysis. Students will be capable of doing analysis of the inorganic materials which are used in our daily life.

Skill enhancement course

CHE-SE-3034: BASIC ANALYTICAL CHEMISTRY

- To familiarize students with different micro and semimicro analytical techniques and help develop the ability to use modern instrumental methods for chemical analysis of food, soil, air and water.
- Students shall be able to explain the basic principles of chemical analysis, design/implement microscale and semimicro experiments, record, interpret and analyze data following scientific methodology.

CHE-SE-4024: GREEN METHODS IN CHEMISTRY

- To introduce about the utilization of green chemistry from industrial perspective and provides exposure to methods by which environmental problems are evaluated and designing of sustainable solutions.
- Students shall be able to describe and evaluate chemical products and processes from environmental perspective, define and propose sustainable solutions and critically assess the methods for waste reduction and recycling.