

## BSC (HONOURS) CHEMISTRY

### Programme Outcomes (POs)

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The student graduating with the Degree B.Sc (Honours) Chemistry should be able to acquire,

- Systematic and coherent understanding of the fundamental concepts in Physical chemistry, Organic Chemistry, Inorganic Chemistry, Analytical Chemistry and all other related allied chemistry subjects.
  - Students will be able to use the evidence based comparative chemistry approach to explain the chemical synthesis and analysis.
  - The students will be able to understand the characterization of materials.
  - Students will be able to understand the basic principle of equipments, instruments used in the chemistry laboratory.
  - Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Chemistry.
  - **Disciplinary knowledge and skill:** A graduate student is expected to be capable of demonstrating comprehensive knowledge and understanding of both theoretical and experimental/applied chemistry knowledge in various fields of interest like Analytical Chemistry, Physical Chemistry, Inorganic Chemistry, Organic Chemistry, Material Chemistry, etc. Further, the student will be capable of using of advanced instruments and related soft-wares for in-depth characterization of materials/chemical analysis and separation technology.
  - **Skilled communicator:** The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.
  - **Critical thinker and problem solver:** The course curriculum also includes components that can be helpful to graduate students to develop critical thinking ability by way of solving problems/numerical using basic chemistry knowledge and concepts.
  - **Sense of inquiry:** It is expected that the course curriculum will develop an inquisitive characteristics among the students through appropriate questions, planning and reporting experimental investigation.
  - **Team player:** The course curriculum has been designed to provide opportunity to act as team player by contributing in laboratory, field based situation and industry.
  - **Skilled project manager:** The course curriculum has been designed in such a manner as to enabling a graduate student to become a skilled project manager by acquiring knowledge about chemistry project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.
  - **Digitally literate:** The course curriculum has been so designed to impart a good working knowledge in understanding and carrying out data analysis, use of library search tools, and use of chemical simulation software and related computational work.
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- **Ethical awareness/reasoning:** A graduate student requires to understand and develop ethical awareness/reasoning, which the course curriculum adequately provides.
- **Lifelong learner:** The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity.

### Course Outcomes (COs)

Paper/Course with code	Course Outcomes
Inorganic Chemistry-I (CHE-HC-1016)	On successful completion, students would have clear understanding of the concepts related to atomic and molecular structure, chemical bonding, periodic properties and redox behaviour of chemical species. Students will also have hands on experience of standard solution preparation in different concentration units and learn volumetric estimation through acid-base and redox reactions.
Physical Chemistry-I (CHE-HC-1026)	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, <i>viz</i> , 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.
Organic Chemistry-I (CHE-HC-2016)	Students will be able to identify different classes of organic compounds, describe their reactivity and explain/analyze their chemical and stereo chemical aspects.
Physical Chemistry-II (CHE-HC-2026)	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.

<p>Inorganic Chemistry-II (CHE-HC-3016)</p>	<p>On successful completion of this course students would be able to apply theoretical principles of redox chemistry in the understanding of metallurgical processes.</p> <p>Students will be able to identify the variety of s and p block compounds and comprehend their preparation, structure, bonding, properties and uses. Experiments in this course will boost their quantitative estimation skills and introduce the students to preparative methods in inorganic chemistry.</p>
<p>Organic Chemistry-II (CHE-HC-3026)</p>	<p>Students will be able to describe and classify organic compounds in terms of their functional groups and reactivity.</p>
<p>Physical Chemistry-III (CHE-HC-3036)</p>	<p>The students are expected to learn phase rule and its application in some specific systems. They will also learn rate laws of chemical transformation, experimental methods of rate law determination, steady state approximation etc. in chemical kinetics unit.</p> <p>After attending this course the students will be able to understand different types of surface adsorption processes and basics of catalysis including enzyme catalysis, acid base catalysis and particle size effect on catalysis.</p>
<p>Inorganic Chemistry-III (CHE-HC-4016)</p>	<p>On successful completion, students will be able name coordination compounds according to IUPAC, explain bonding in this class of compounds, understand their various properties in terms of CFSE and predict reactivity. Students will be able to appreciate the general trends in the properties of transition elements in the periodic table and identify differences among the rows.</p> <p>Through the experiments students not only will be able to prepare, estimate or separate metal complexes/compounds but also will be able to design experiments independently which they should be able to apply if and when required.</p>
<p>Organic Chemistry-III (CHE-HC-4026)</p>	<p>Students shall demonstrate the ability to identify and classify different types of N-based derivatives, alkaloids and heterocyclic compounds/explain their structure mechanism and reactivity/critically examine their synthesis and reactions mechanism.</p>
<p>Physical Chemistry-IV (CHE-HC-4036)</p>	<p>In this course the students will learn theories of conductance and electrochemistry. Students will also understand some very important topics such as solubility and solubility products, ionic products of water, conductometric titrations etc. The students are also expected to understand the various parts of electrochemical cells along with Faraday's Laws of electrolysis. The students will also gain basic</p>

	theoretical idea of electrical & magnetic properties of atoms and molecules.
Organic Chemistry-IV (CHE-HC-5016)	Students will be able to explain/describe the important features of nucleic acids, amino acids and enzymes and develop their ability to examine their properties and applications.
Physical Chemistry-V (CHE-HC-5026)	After completion of this course the students are expected to understand the application of quantum mechanics in some simple chemical systems such as hydrogen atom or hydrogen like ions. The students will also learn chemical bonding in some simple molecular systems. They will be able to understand the basics of various kinds of spectroscopic techniques and photochemistry.
Inorganic Chemistry-IV (CHE-HC-6016)	By studying this course the students will be expected to learn about how ligand substitution and redox reactions take place in coordination complexes. Students will also learn about organometallic compounds, comprehend their bonding, stability, reactivity and uses. They will be familiar with the variety of catalysts based on transition metals and their application in industry.  On successful completion, students in general will be able to appreciate the use of concepts like solubility product, common ion effect, pH etc. in analysis of ions and how a clever design of reactions, it is possible to identify the components in a mixture. With the experiments related to coordination compound synthesis, calculation of $10Dq$ , controlling factors etc. will make the students appreciate the concepts of theory in experiments.
Organic Chemistry-V (CHE-HC-6026)	Students will be able to explain/describe basic principles of different spectroscopic techniques and their importance in chemical/organic analysis. Students shall be able to classify/identify/critically examine carbohydrates, polymers and dye materials.
Analytical Methods in Chemistry (CHE-HC-5026)	On successful completion students will be have theoretical understanding about choice of various analytical techniques used for qualitative and quantitative characterization of samples. At the same time 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.
Novel Inorganic Solids (CHE-HC-5046)	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.
Green Chemistry (CHE-HC-5046)	Apart from introducing learners to the principles of green chemistry, 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. They also will have the option of studying further in the area.
Basic Analytical Chemistry (CHE-HC-3034)	Upon completion of this course, 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.
Fuel Chemistry (CHE-HC-4064)	At the end of this course students will learn about the classes of renewable and non-renewable energy sources. Students will learn about the composition of coal and crude petroleum, their classification, isolation of coal and petroleum products and their usage in various industries. They will also learn to determine industrially significant physical parameters for fuels and lubricants.