

**Programme specific outcome and Course outcome of 2022-23 session (CBCS)**

<b>DEPARTMENT OF CHEMISTRY</b>	
<b>B.Sc. (Chemistry) General and Honours</b>	
<b>Programme Specific Outcome</b>	<p>PO1. Students will have broad and balanced knowledge in chemistry in addition to understanding of key chemical concepts, principles, and theories.</p> <p>PO2. Students will acquire expertise over solving both theoretical and applied chemistry problems.</p> <p>PO3. Students will have knowledge, ability, and skill to undertake further studies in chemistry or in related multidisciplinary areas that can be helpful for higher studies. In addition, a chemistry graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.</p> <p>PO4. Students will be sensitized on problems related environmental issues and will be able to correlate the importance of green chemistry.</p> <p>PO5. Cognitive development of students in a holistic manner, that provides the latest subject matter (both theoretical as well as practical), in such a way that foster their core competency and discovery learning.</p> <p>PO6. Mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.</p> <p>PO7. Enable the graduates to compete in national/international and state level competitive examinations, such as IIT-JAM, CUCET, UPSC Civil Services Examination etc.</p>

<b>Course Outcomes of B.Sc (Chemistry) General and Honours</b>			
<b>Semester</b>	<b>Course Category</b>	<b>Paper Code and Course Name</b>	<b>Outcomes</b>
<b>1<sup>st</sup></b>	<b>Generic/Regular</b>	<b>CHE-RC-1016 Chemistry 1</b>	<p>1. The students will learn the atomic structure through the basic concepts of quantum mechanics.</p> <p>2. They will understand the chemical bonding through VB and MO approaches.</p> <p>3. The students are expected to learn basic ideas used in organic chemistry, stereochemistry, functional groups, alkanes, alkenes, alkynes etc.</p>

	<b>Honours</b>	<b>CHE-HC-1016 Inorganic chemistry</b>	<p>1. Students will understand the concepts related to atomic and molecular structure, chemical bonding, periodic properties and redox behaviour of chemical species.</p> <p>2. Students will have hands on experience of standard solution preparation in different concentration units and learn volumetric estimation through acid-base and redox reactions.</p>
	<b>Honours</b>	<b>CHE-HC-1026 Physical Chemistry</b>	<p>1. Students will acquire knowledge about the kinetic theory of gases, ideal gas and real gases.</p> <p>2. They will learn the qualitative treatment of the structure of liquid along with the physical properties of liquid, viz, vapour pressure, surface tension and viscosity.</p> <p>3. They will have the knowledge about molecular and crystal symmetry which will be useful in understanding in solid state chemistry and group theory in some higher courses.</p> <p>4. Students will learn the basic solid state chemistry application of x-ray crystallography for the determination of some very simple crystal structures. Moreover, they will also learn about “ionic equilibria” in this course and a hand on knowledge about the properties of liquid.</p>

<b>2<sup>nd</sup></b>	<b>Generic/Regular</b>	<b>CHE-RC-2016 Chemistry 2</b>	<ol style="list-style-type: none"> <li>1. Students will learn periodic properties in main group elements, transition metals (3d series).</li> <li>2. They will also learn the crystal field theory in coordination chemistry unit.</li> <li>3. Students are expected to learn kinetic theory of gases, ideal gas and real gases, surface tension, viscosity, basic solid state chemistry and chemical kinetics.</li> </ol>
	<b>Honours</b>	<b>CHE-HC-2016 Organic Chemistry</b>	<ol style="list-style-type: none"> <li>1. Students will be able to identify different classes of organic compounds, describe their reactivity and explain/analyze their chemical and stereochemical aspects.</li> <li>2. They will have knowledge on characterization, properties and separation of unknown organic compounds.</li> </ol>
	<b>Honours</b>	<b>CHE-HC-2026 Physical Chemistry</b>	<ol style="list-style-type: none"> <li>1. Students will have knowledge about the laws of thermodynamics, thermochemistry, thermodynamic functions, relations between thermodynamic properties, Gibbs Helmholtz equation, Maxwell relations etc.</li> <li>2. Besides these, students will learn partial molar quantities, chemical equilibrium, solutions and colligative properties.</li> <li>3. After completion of this course, the students will be able to understand the chemical systems from thermodynamic point of view.</li> </ol>

3 <sup>rd</sup>	<b>Generic/Regular</b>	<b>CHE-RC-3016 Chemistry 3</b>	<p>1. After completion of this course, students will be able to understand the chemical system from thermodynamic points of view.</p> <p>2. They will also learn two important topics in chemistry- chemical equilibrium and ionic equilibrium.</p> <p>3. In organic chemistry part, the students are expected to learn various classes of organic molecules-alkyl halides, aryl halides, alcohols, phenols, ethers, aldehydes and ketones.</p>
	<b>Honours</b>	<b>CHE-HC-3016 Inorganic Chemistry</b>	<p>1. 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>2. Students will be able to identify the variety of s and p block compounds and comprehend their preparation, structure, bonding, properties and uses.</p> <p>3. Experiments in this course will boost their quantitative estimation skills and introduce the students to preparative methods in inorganic chemistry.</p>

	<b>Honours</b>	<b>CHE-HC-3026 Organic Chemistry</b>	Students will be able to describe and classify organic compounds in terms of their functional groups and reactivity.
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<b>3<sup>rd</sup></b>	<b>Honours</b>	<b>CHE-HC-3036 Physical Chemistry</b>	<p>1. 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>2. 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>
	<b>Generic/Regular/Honours (Skill Enhancement Course (SEC))</b>	<b>CHE-SE-3074 Intellectual Property Rights</b>	<p>1. After completing this course, students will have in-depth understanding about the importance and types of intellectual property rights.</p> <p>2. This course will also provide the clarity on the legal and economic aspects of the IP system.</p>
		<b>CHE-SE-3024 IT Skills for Chemists</b>	<p>1. Course learning outcomes focus on skill development related to basic computer operations and information technology.</p> <p>2. After completing the course students will be able to use the computer for basic purposes of preparing his personnel/business letters, viewing information on Internet (the web), sending mails, using internet banking services etc.</p> <p>3. Students will accumulate the skills in writing activities and handling numeric data.</p>
		<b>CHE-SE-3034 Basic Analytical Chemistry</b>	<p>1. Upon completion of this course, students shall be able to explain the basic principles of chemical analysis.</p>

			2. They will be able to design microscale and semimicro experiments, record, interpret and analyze data following scientific methodology.
4 <sup>th</sup>	<b>Generic/Regular</b>	<b>CHE-RC-4016 Chemistry 4</b>	CO1. After completion of this course the students learn solutions, phase rule and its application in specific cases, basics of conductance and electrochemistry. CO2. Students will also learn some important topics of organic and biochemistry- carboxylic acids, amines, amino acids, peptides, proteins and carbohydrates.
	<b>Honours</b>	<b>CHE-HC-4016 Inorganic Chemistry</b>	1. 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. 2. 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. 3. 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.
4 <sup>th</sup>	<b>Honours</b>	<b>CHE-HC-4026 Organic Chemistry</b>	Students shall demonstrate the ability to identify and classify different types of N-based derivatives, alkaloids and heterocyclic compounds.

			They will be able to explain their structure, reactivity and critically examine their synthesis and reactions mechanism.
	<b>Honours</b>	<b>CHE-HC-4036 Physical Chemistry</b>	<p>1. In this course the students will learn theories of conductance and electrochemistry.</p> <p>2. Students will also understand some particularly important topics such as solubility and solubility products, ionic products of water, conductometric titrations, various parts of electrochemical cells along with Faraday's Laws of electrolysis.</p> <p>3. The students will also gain basic theoretical idea of electrical &amp; magnetic properties of atoms and molecules.</p>
	<b>Generic/Regular/Honours (SEC)</b>	<b>CHE-SE-4014: Analytical Clinical Biochemistry</b>	Students will be able to identify various molecules relevant to a particular pathological condition and their estimation protocols
		<b>CHE-SE-4024: Green Methods in Chemistry</b>	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.
		<b>CHE-SE-4034 Pharmaceutical Chemistry</b>	Students will be able to appreciate the development process, identify various small molecules used for treatments different ailments and other physiological processes.



<b>5<sup>th</sup></b>	<b>Honours</b>	<b>CHE-HC-5016</b>  <b>Organic Chemistry</b>	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.
	<b>Honours</b>	<b>CHE-HC-5026</b> <b>Physical Chemistry</b>	<p>1. 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.</p> <p>2. Students will also learn chemical bonding in some simple molecular systems.</p> <p>3. They will be able to understand the basics of various kinds of spectroscopic techniques and photochemistry</p>
	<b>Generic/Regular / Honours</b>	<b>CHE-RE-5016</b> <b>CHE-HE-5016</b>  <b>Applications of Computers in Chemistry</b>	After the completion of this course, it will help the student to interpret laboratory data, curve fitting of experimental work, also perform quantum mechanical calculations for various molecular models
		<b>CHE-RE-5026</b> <b>CHE-HE-5026</b>  <b>Analytical Methods in Chemistry</b>	<p>1. On successful completion students will have theoretical understanding about choice of various analytical techniques used for qualitative and quantitative characterization of samples.</p> <p>2. 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.</p>

5 <sup>th</sup>	(Discipline Specific Elective (DSE))	<b>CHE-RE-5036</b> <b>CHE-HE-5036</b>  <b>Molecular Modelling &amp; Drug Design</b>	Students will be able to identify basic components of computer and programming as applied to computer assisted design and modelling of molecules.
		<b>CHE-RE-5046</b> <b>CHE-HE-5046</b>  <b>Novel Inorganic Solids</b>	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.
		<b>CHE-RE-5056</b> <b>CHE-HE-5056</b>  <b>Polymer Chemistry</b>	<ol style="list-style-type: none"> <li>1. After completion of this course the students will learn the definition and classifications of polymers, kinetics of polymerization, molecular weight of polymers, glass transition temperature, and polymer solutions etc.</li> <li>2. They also learn the brief introduction of preparation, structure and properties of some industrially important and technologically promising polymers.</li> </ol>
		<b>CHE-RE-5066</b> <b>CHE-HE-5066</b>  <b>Instrumental Methods of Chemical Analysis</b>	Students shall be able to explain the theoretical basis of different analytical techniques, identify the experimental requirements and compare/analyze the data/results thereof.
5 <sup>th</sup>		<b>CHE-SE-5014:</b> <b>Chemical Technology &amp; Society</b>	<ol style="list-style-type: none"> <li>1. Students shall be familiarized with processes and terminologies in chemical industry, like mass balance, energy balance etc.</li> <li>2. Learners will be able to use chemical and scientific literacy as a mean to better</li> </ol>

	<p style="text-align: center;"><b>Regular (SEC)</b></p>		<p>understand the topics related to the society.</p>
<p style="text-align: center;"><b>CHE-SE-5024: Cheminformatics</b></p>		<ol style="list-style-type: none"> <li>1. On the successful completion of the course, the students should be able to explain, interpret and critically examine the utility of computers and software tools to solving chemistry related problems.</li> <li>2. Recognize, apply, compare, and predict chemical structures, properties, and reactivity and solve chemistry related problems.</li> <li>3. Employ critical thinking and scientific reasoning to design and safely implement laboratory experiments and keep the records of the same.</li> <li>4. Compile, interpret and analyze the qualitative/quantitative data and communicate the same in a scientific literature</li> </ol>	
<p style="text-align: center;"><b>CHE-SE-5034: Business Skills for Chemists</b></p>		<p>Students shall be able to explain and/or analyze the important steps of business operations, finance, and intellectual property as applied to chemical industry.</p>	
<p style="text-align: center;"><b>CHE-SE-5044 Intellectual Property Rights</b></p>		<ol style="list-style-type: none"> <li>1. After completing this course, students will have in-depth understanding about the importance and types of intellectual property rights.</li> <li>2. This course will also provide the clarity on the legal and economic aspects of the IP system.</li> </ol>	

6 <sup>th</sup>		<b>CHE-HC-6016 Inorganic Chemistry</b>	1. Students will be expected to learn about how ligand substitution and redox reactions take place in coordination complexes.
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6 <sup>th</sup>	<b>Honours</b>		<p>2. Students will also learn about organometallic compounds, comprehend their bonding, stability, reactivity and uses.</p> <p>3. They will be familiar with the variety of catalysts based on transition metals and their application in industry.</p> <p>4. 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.</p> <p>5. 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.</p>
	<b>Honours</b>	<b>CHE-HC-6026 Organic Chemistry</b>	<p>1. Students will be able to explain/describe basic principles of different spectroscopic techniques and their importance in chemical/organic analysis.</p> <p>2. Students shall be able to classify/identify/critically examine carbohydrates, polymers and dye materials.</p>
		<b>CHE-RE-6016 CHE-HE-6016 Green Chemistry</b>	<p>1. Apart from introducing learners to the principles of green chemistry, this course will make them conversant with applications of green chemistry to organic synthesis.</p> <p>2. 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.</p>

6 <sup>th</sup>	Generic/Regular / Honours  (DSE)		
		<b>CHE-RE-6026</b> <b>CHE-HE-6026</b>  <b>Industrial Chemicals and Environment</b>	<p>1. After successful completion of course, students would have learnt about the manufacture, applications and safe waysof storage and handling gaseous and inorganic industrial chemicals. Students will get to know about industrial metallurgy and the energy generation industry.</p> <p>2. Students will also learn about environmental pollution by various gaseous, liquid wastes and nuclear wastes and their effects on living beings.</p> <p>3. Finally, the students will learn about industrial waste management, their safe disposal and the importance of environment friendly “green chemistry” in chemical industry.</p>
		<b>CHE-RE-6036</b> <b>CHE-HE-6036</b>  <b>Inorganic Materials of Industrial Importance</b>	<p>1. This course will establish the foundation of industrial inorganic chemistry among the students. This will be helpful for pursuing further studies of industrial chemistry in future.</p> <p>2. Experiments will help the students to gather the experience of qualitative and quantitative chemical analysis.</p> <p>3. Students will be capable of doing analysis of the inorganic materials which are used in our daily life. They will have insight of the industrial processes.</p>
		<b>CHE-RE-6046</b> <b>CHE-HE-6046</b>	<p>After completing this course, students should be able to construct a rational research</p>

6 <sup>th</sup>		<b>Research Methodology for Chemistry</b>	proposal to generate fruitful output in terms of publications and patents in the field of chemical sciences.
		<b>CHE-RE-6056 CHE-HE-6056 Dissertation</b>	This course is a project related work. Students will carry out experimental or theoretical project, analyse the results and write a project report. This course will train students to conduct research in scientific manner.
6 <sup>th</sup>	<b>Regular</b>	<b>CHE-SE-6014 Chemistry of Cosmetics &amp; Perfumes</b>	1. Students will learn about the preparation and chemistry involved with the production different cosmetic. 2. This may encourage students to take up entry level jobs at cosmetics industry or venture into commercial production of cosmetics as an entrepreneur.
		<b>CHE-SE-6024 Pesticide Chemistry</b>	Students will be able to explain or describe and critically examine different types of pesticides, their activity/toxicity and their applications and the need for the search of an alternative based on natural products.
		<b>CHE-SE-6034 Fuel Chemistry</b>	1. At the end of this course students will learn about the classes of renewable and non-renewable energy sources 2. 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. 3. They will also learn to determine industrially significant physical

			parameters for fuels and lubricants.
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