
DEPARTMENT OF CHEMISTRY

B. SC. IN CHEMISTRY

AIMS AND OBJECTIVES OF COURSE STRUCTURE OF B.SC. CHEMISTRY

- ❖ To promote understanding of basic facts and concepts in Chemistry while retaining the excitement of Chemistry.
- ❖ To make students capable of studying Chemistry in academic and Industrial courses.
- ❖ To expose the students to various emerging new areas of Chemistry and apprise them with their prevalent in their future studies and their applications in various spheres of chemical sciences.
- ❖ To develop problem solving skills in students.
- ❖ To expose the students to different processes used in Industries and their applications.
- ❖ To develop ability and to acquire the knowledge of terms, facts, concepts, processes, techniques and principles of subjects,
- ❖ To develop ability to apply the knowledge of contents of principles of chemistry.
- ❖ To inquire of new knowledge of chemistry and developments therein.
- ❖ To expose and to develop interest in the fields of chemistry
- ❖ To develop proper aptitude towards the subjects.
- ❖ To develop the power of appreciations, the achievements in Chemistry and role in nature and society.
- ❖ To develop skills required in chemistry such as the proper handling of apparatus and chemicals.

After successful completion of Under Graduate Degree Program in Chemistry student should be able to understand...		
Sr. No.	Program outcomes (POs)	Program specific outcomes (PSOs)
1	Provide students an excellent academic experience and equip them with ability to solve a broad range of problems in our rapidly-changing technological environment.	Understand Basic Fundamentals of Chemical Sciences.
2	Strong foundation and knowledge in scientific fundamentals with a capacity to know how, when and where to use the knowledge in specific ways.	Build a strong knowledge of Basics concepts of Chemistry in particular Physical, Inorganic, Organic and Analytical Chemistry
3	Gain comprehensive understanding of the principles and practices of Chemical Sciences and broad-based concepts in an interdisciplinary structure	Comprehend Importance of Industrial and medical application of Chemistry and some applied aspects of Chemistry in Industries.
4	To gain the experimental skills, should Perform Experiments, Analyze and interpret data for investigating basic problems in Chemical Sciences and related fields.	Learn principal techniques of chemical analysis required to work in a Chemistry Laboratory and Industry.

Semester-I and II F. Y. B. Sc. [Chemistry]

After successful completion of the course students should able to	
Course	Outcomes
CH-101 Physical and Inorganic Chemistry	<ul style="list-style-type: none"> • Students should be able to define and explain the equivalent conductance • Students should able to differentiate, integrates the given functions. • Students can compare the elements on the basis of periodic properties. • Students are able to correlate the theoretical concepts of chemistry with practical approach.
CH-102 Organic and Inorganic Chemistry	<ul style="list-style-type: none"> • Students should able to define alkanes, alkenes and alkynes, and their reactions. • Students should able to write nomenclature common and IUPAC. • Students should able to explain geometry of molecules using VSEPR theory.
CH-103 Practical Chemistry	<ul style="list-style-type: none"> • Students should calibrate volumetric apparatus. • Students should able to prepare the solutions of different concentrations. • They can analyze the inorganic compounds
CH-201 Physical and Inorganic Chemistry	<ul style="list-style-type: none"> • Students should be able to define and explain laws and principles of physical chemistry. • Students can explain surface tension and its applications.

	<ul style="list-style-type: none"> • Students should be able to explain different steps in metallurgical process. • Students are able to write electron configuration of P-block elements and understand bonding and shapes of different molecules.
CH-202 Organic and Inorganic Chemistry	<ul style="list-style-type: none"> • Students should be able to write common and IUPAC names of aldehyde and ketones, and can prepare using different reactions. • should be able to write nomenclature common and IUPAC system, of carboxylic acid and their derivatives. Preparation using different methods. • Students should be able to explain ionic, covalent, coordinate bonds, metallic bond.
CH-203 Practical Chemistry	<ul style="list-style-type: none"> • Students should be able to determine heat of solution, viscosity of different solution. • They can determine normality and strength of given acids. • Able to determine percentage composition of organic solutions.

Semester-V (TY B.Sc. Chemistry)

After completion of this course students should able to

Course Objectives	Course Outcomes
CH-501: Principals of Physical Chemistry <ul style="list-style-type: none">• To orient and acquaint the students towards the basic concepts Quantum Chemistry• To acquire knowledge about rates of chemical reactions and distinguishing the reaction of different order and their characteristics.• To understand the basic principles of phase rules and phase diagrams.• To learn the underlying principles of electrode reactions, electrochemical cells and applications of EMF.	Students are expected to: <ul style="list-style-type: none">• Understand the significance of wave function and postulates of quantum mechanics.• Deduce rate equations and half-life equations for first and second order reactions• Draw and explain the one and two component system phase diagrams.• Explain the principles of electrode processes and apply them during Practicals.
CH-502: Inorganic Chemistry <ul style="list-style-type: none">• To describe the VSEPR theory to predict shape of molecules from electron pairs.• To describe the bonding in simple compounds using VBT.• To describe the principles of VBT to predict hybridization of orbitals.• To understand how CFT explains electronic structure, colour and magnetic properties of co-ordination compounds.• To introduce the basic principles of MOT and electronic geometry of molecules.	<ul style="list-style-type: none">• Learn about the VSEPR theory and how it can be used to explain molecular shapes.• Learn about the VBT to describe the formation of covalent bonds in terms of atomic orbital overlap.• Learn about stability of complexes using CFSE.• Learn about MOT to draw energy diagrams and to predict bond order.
CH-503: Organic Reaction Mechanism <ul style="list-style-type: none">• To study different types of organic reactions.• To understand the mechanisms of different types of reactions.• To distinguish between types of substrates and types of reagents.• To understand ways of attack of reagent, breaking and formation of bonds in different reaction mechanisms.• To study kinetics, evidences and factors affecting different types of reactions.• To study stereochemistry of different reactions.	<ul style="list-style-type: none">• Students will learn organic reactions like nucleophilic substitution, electrophilic substitution, nucleophilic addition, electrophilic addition and elimination.• Students will be able to write/ explain mechanisms of those types of reactions.• Students will understand how a reaction takes place in one or more steps.• Students will understand the types of intermediates formed in different reactions.

<ul style="list-style-type: none"> • To understand role of different reagents in different reactions. 	<ul style="list-style-type: none"> • Students will learn how reagent attacks the substrate molecule and accordingly how bonds break and formed. • Students will learn how change in structure of substrate, reagent and solvent changes the product formed and its stereochemistry. • Students will be able to predict the products and to suggest the mechanisms.
<p>CH-504: Industrial Chemistry</p> <ul style="list-style-type: none"> • To produce graduates with enhanced skills, applied knowledge, aptitude to carry out higher studies or research and development in the various industrial areas. • To make the student cognizant about important aspects of Chemical Industries, Industrial work culture and environment. • To prepare the students for immediate entry to the workplace with sound theoretical knowledge and some basic experimental concepts in the area of various industries viz. Sugar Industry, Fermentation Industry, Petroleum and Petrochemicals. • To offers the synergism between basic concepts of Chemistry with Industrial applications. • To equip the students with knowledge of some industrial organic synthesis as requirement of diverse chemical industries. • Empower the students to understand the concepts in chemical processing, engineering and industrial development. 	<ul style="list-style-type: none"> • Basic requirements of Chemical Industry, different terms, operations and processes involved in chemical Industry. • Describe Copy Right Act, Patent Act and Trade Marks, Bureau of Indian Standards (BIS) and International Organization for Standardization (ISO). • Basic requirements, raw materials, different processes and operations involved in Sugar Industry and also different grades of sugar and uses of by-products of sugar industry. • Importance of fermented products, basic requirements, theory and process of alcohol making, fractional distillation and various terms involved in Fermentation Industry. • Understand Occurrence of Petroleum, theories of formation of Petroleum and different terms Viz. Knocking, Anti-Knock Compounds, Octane number, Cetane number, Gasohol and Power alcohol etc. • Manufacturing processes involved in Industrial Organic Synthesis such as Methanol, Isopropanol, Glycerol, Acetylene and Aromatic hydrocarbon i.e. Toluene from petroleum with their uses.
<p>CH-505: Analytical Chemistry</p> <ul style="list-style-type: none"> • To develop an understanding of the range and uses of analytical methods in chemistry. <ul style="list-style-type: none"> • To understand and establish the role of chemistry in quantitative analysis. • To enhance the Analytical instrumental skill of the students. 	<ul style="list-style-type: none"> • Explain the fundamentals of analytical methods and instruments for qualitative and quantitative Analysis. • Express the role of analytical chemistry in science. • Students will be able to function as a member of an interdisciplinary problem solving team.

CH-506(B): Green Chemistry

- There is rising concern since 1970 about environmental pollution, depleting resources, climate change, ozone depletion, legislation which is getting stringent with strict environmental laws, rising cost of waste deposits, health concern and so on.
- We are facing the challenge to work towards sustainable development. Since 1990, today's society is moving towards becoming more and more environmentally conscious.
 - Green chemistry has been introduced in 1990 for overall sustainable development against the environmental concerns.
 - Green chemistry is not a new branch of chemistry, but it is a new way chemistry, which should be practiced regularly.
 - Innovations and applications of green chemistry in education has helped companies not only to gain environmental benefits but at the same time to achieve economic and societal goals also.
 - This is possible because these undergraduate students are ultimate scientific community of tomorrow.

- With this course, the graduate students will be able to understand the twelve principles of green chemistry that will help to build the basic understanding of toxicity, hazards and risk of chemical substances.
- The course will help to understand stoichiometric calculations and relate them to green chemistry metrics. The students will learn about atom economy and understand its importance over percentage yield.
- The students will learn to design safer chemicals, products and processes that are less toxic than the conventional chemistry, understand significance of catalysis, use of renewable feed stock, renewable energy sources, importance of green solvents, etc.
- The course will train the students to appreciate green chemistry and boost the students to think and develop the skills to innovate and search for the solutions to environmental problems.
- Green chemistry is only way of future chemistry to ensure sustainability with absolute zero waste. The success stories and real-world cases will motivate the young generation to practice green chemistry.

CH-507 and 607 Practical Course: Physical Chemistry

- To develop skills required in chemistry such as the appropriate handling of apparatus, instruments and chemicals.
- The student will learn the laboratory skills needed to design, safely conduct and interpret chemical research.
- To expose the students to an extent of experimental techniques using modern instrumentation.
- The student will develop the ability to effectively communicate scientific information and research results in written and oral formats.

- Students will get basic analytical and technical skills to work effectively in the various fields of chemistry.
- Students will be able to calibrate and handle instruments like conductometer, potentiometer, pH meter, colorimeter, spectrophotometer, polarimeter.
- They have ability to perform accurate quantitative measurements with an understanding of the theory and use of contemporary chemical instrumentation, interpret experimental results, perform calculations on these results and draw reasonable, accurate conclusions.
- They get skills required in chemistry such as the proper handling of apparatus and chemicals.

	<ul style="list-style-type: none"> • They will have ability to present scientific and technical information resulting from laboratory experimentation in both written and oral formats
CH-508: Practical Course: Inorganic Chemistry <ul style="list-style-type: none"> • To analyze the inorganic mixtures. • To determine metal from ore and alloy analysis. • Using colorimetric analysis to determine amount of metal. 	<ul style="list-style-type: none"> • Student will able to determine cation & anion from inorganic mixtures by using qualitative analysis. • Student will able to determine metal from ore & alloys. • Students will be able to design & carry out scientific experiments as well as accurately record & analyze the results of experiments. • Students will be able to handle colorimeter for estimation of metal ions.
CH-509 and 609 Practical Course: Organic Chemistry <ul style="list-style-type: none"> • To develop skills required in chemistry such as the appropriate handling of apparatus and chemicals. • The student will learn the laboratory skills needed to design, safely conduct and interpret chemical research. • To expose the students to an extent of experimental techniques using modern instrumentation. • The student will develop the ability to effectively communicate scientific information and research results in written and oral formats. 	<ul style="list-style-type: none"> • Separate and analyze binary water insoluble mixture. • Separate and analyze binary water soluble mixture. • Estimate - Acetamide, Glucose and Glycine by volumetric method, • Estimate basicity of various acids. • Synthesis of various organic compounds through greener alternatives. • Understand Thin Layer Chromatographic techniques and physical constant. • Understand the purification technique use in organic chemistry.

Semester-VI (TY B.Sc. Chemistry)

After completion of these courses students should able to	
Course	Outcomes

<p>CH-601: Principals Physical Chemistry</p> <ul style="list-style-type: none"> • To learn the basics of molecular spectroscopy and rotational spectra. • To understand the basic principles and applications of nuclear chemistry. • To learn the consequences of light absorption by atoms and molecules and photochemical reactions. • To learn the laws of crystallography and basics of crystal structure. 	<ul style="list-style-type: none"> • Analyze the rotational spectra of diatomic molecules and determine the bond length. • Explain and apply the radioactivity principles for various chemical and biological investigations. • Describe the mechanism of fluorescence, phosphorescence and photochemical reactions. • Analyze the given crystal structure and determine the indices of planes, interplaner distances and type of crystal structure.
<p>CH-602: Inorganic Chemistry</p> <ul style="list-style-type: none"> • To describe basic principles of nanomaterials. • To describe basic synthesis of nanoparticles. • To describe composition and technological importance of inorganic solids. • To describe composition of cement, lime and alloys. • To describe manufacture of fertilizers. 	<ul style="list-style-type: none"> • Learn about basic principles and synthesis of nanomaterials. • Learn about classification, composition and processing of cement. • Learn about classification and composition of alloys. • Learn about types manufacture and applications of fertilizers.
<p>CH-603: Spectroscopic Methods of Structure Determination</p> <ul style="list-style-type: none"> • To study principle of spectroscopy and to understand wave parameters and terms involved in spectroscopy. • To study different types of spectroscopy. • To understand principle, concept and the terms used in each type of spectroscopy. • Interpretation of UV, IR, NMR spectra. • Use of spectral data for determination of structure of unknown organic compounds. • To study different applications of each type of spectroscopy. 	<ul style="list-style-type: none"> • Students will learn interaction of radiations with matter and different regions of electromagnetic radiations. They will know different wave parameters. • Will learn principle of mass spectroscopy, its instrumentation and nature of mass spectrum. • Students will understand principle of UV spectroscopy and nature of UV spectrum and will be able to calculate maximum wavelength for any conjugated system. • Students will understand principle of IR spectroscopy, types of vibrations and the nature of IR spectrum. will be able to find out IR frequencies of different functional groups. • Students will understand principle of NMR spectroscopy and terms used in NMR spectroscopy. They will learn measurement of chemical shift and coupling constants.

	<ul style="list-style-type: none"> • Students will be able to interpret the NMR data and they will be able to use it for determination of structure of organic compound. • Students will be able to determine structure of simple organic compounds on the basis of spectral data such as λ max values, IR frequencies, chemical shift (δ values)
<p>CH-604: Chemistry of Industrially Products</p> <ul style="list-style-type: none"> • To make student perceptive about various commodity industries viz. Cosmetics and Perfumes, Dyes and Pharmaceuticals, Pesticides, Soaps and Detergents, related diversified and multidisciplinary fields of chemical industry. • To produce graduates with enhanced skills, knowledge and research aptitude to carry out higher studies or research and development in the various industrial areas. • To equip students with advance knowledge about various industrially important products. • To makes students ready for immediate entry to the workplace with sound theoretical and basic experimental knowledge in the areas of various industries. • To engender the substantial interest in the students to understand the concepts in chemical processing, engineering and industrial development of present era viz. Cosmetics and Perfumes Industry, Dyes and Pharmaceuticals, Pesticides, Soaps and Detergents, related multidisciplinary and diversified fields of chemical industry. <ul style="list-style-type: none"> • To describe the industrial production of a number of important organic and inorganic compounds / chemicals and products of end use. • To gain comprehensive knowledge of cutting-edge developments in a field of different chemical industries by discussions and exchange of experiences and knowledge. • To develop proficiency in application of current aspects of industrial chemistry. 	<ul style="list-style-type: none"> • Describe the industrial production of a number of important organic and inorganic compounds / chemicals and products of end use. • Gain comprehensive knowledge of cutting-edge developments in a field of different chemical industries. • Importance of Cosmetics Industry and a general study including preparation and uses of the Hair dye, hair spray, shampoo, suntan lotions, lipsticks, talcum powder, nail enamel, creams (cold, and shaving creams). • Perfumes and identify the distinguishing features of its components and also an essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmone, Civetone, Muscone etc. • Know about pesticides both natural and synthetic, benefits and adverse effects of it, also synthesis, manufacture and uses of pesticides viz. Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion); Anilides (Alachlor and Butachlor). • Definition, classification, raw material used in soaps and detergents, reaction involved in it, Manufacture of Soaps and cleansing action of soaps and detergents. • Definition, properties of good dyes, relation between colour and constitution, classification of dyes according to their mode of application and chemical constitution. • Importance's, definition and meaning of the different terms involved in Drugs and Pharmaceuticals Industry and also synthesis, uses, properties and industrial manufacture of Paracetamol, Aspirin, and Chloramphenicol

<p>CH-605: Analytical Chemistry</p> <ul style="list-style-type: none"> • To provide knowledge of instruments which are used in Chemical, Pharma, Petroleum, and insecticide and pesticide industry • To increase student technical skill as per industry need. • To develop an understanding of the range and uses of analytical methods in chemistry. 	<ul style="list-style-type: none"> • Compare the Instrumental methods and non instrumental methods and there advantages. • Solve the problem of detection and separation using analytical instruments. • Students will be able to explore new areas of research in bothchemistry and allied fields of science and technology. • Students will be able to explain why chemistry is an integral activity for addressing social, economic, and environmental problems.
<p>CH-606(A): Polymer Chemistry</p> <ul style="list-style-type: none"> • The course offers the basic concepts of polymer, polymerization, classes of polymers, important properties, and poly(lactic acid) as a biodegradable polymer. • The course also offers to study preparation, properties, and applications of industrially important selected polymers. • The course will give chance to study various mechanisms of polymerization and learn different techniques of polymerization. • The student will be able to understand glass transition temperature and factors affecting on it and various ways to express molecular weight of polymers. 	<ul style="list-style-type: none"> • Define terms like monomer, polymer, polymerization, polydispersity index, etc., classify polymers based on their origin, native backbone chain, and thermal response. • Know glass transition temperature and its determination, various ways to express molecular weights of polymers and polydispersity index. • Identify different mechanisms of polymerizations viz. free radical, ionic, and condensation polymerizations. • Distinguish techniques of polymerization based on physical conditions required for the preparation of polymers in laboratory or industry. • Familiar with preparation, properties, and applications of industrially important selected polymers
<p>CH-608: Practical Course: Inorganic Chemistry</p> <ul style="list-style-type: none"> • To determine metal from gravimetric estimations. • To determine amount of metal by volumetric analysis. • To determine preparation /synthesis of co-ordination compound. • To study separation techniques of metals. • To use colorimetric analysis of metal. 	<ul style="list-style-type: none"> • Students will be able to prepare co-ordination compounds. • Students will be able to determine amount of metal by using quantitative analysis. • Students will be able to calculate Rf value of metal. • Students will be able to design & carry out scientific experiments as well as accurately record & analyze the results of experiments. • Students will be able to explain why chemistry is an integral activity for addressing social, economic & environmental problems.