

# **B.Sc Chemistry**

## **Program Outcome**

**PO1.** demonstrate knowledge of the basic principles of major fields of chemistry.

**PO2.** demonstrate a broad range of basic laboratory skills applicable to chemistry, and improved chemical research skills.

**PO3.** Understand the objective of their chemical experiments, properly carry out the experiments, and appropriately record and analyze the results.

**PO4.** Know and follow the proper procedures and regulations for safe handling and use of chemicals.

**PO5.** To inculcate the scientific temperament in the students and outside the scientific community.

## **Program Specific Outcome**

**PSO1.** Understand the various type of aliphatic, aromatic, nucleophilic substitution reaction.

**PSO2.** . Understand and apply principles of Organic Chemistry for understanding the scientific phenomenon in Reaction mechanisms.

**PSO3.** Understand good laboratory practices and safety.

**PSO4.** Understanding of free radical, bicyclic compound, conjugate addition of Enolates and pericyclic reactions.

**B.Sc. CHEMISTRY**  
**COURSE OUTCOME**

**F.Y.B.Sc. Chemistry**

**Paper-I: Physical Chemistry**

**Sem- I**

On completion of the course F.Y B.Sc. student will able to

**Co 1.** Apply thermodynamic principles to physical and chemical processes also applications of it.

**Co 2.** Relate Chemical equilibrium with free energy gas equilibrium – equilibrium constant, Vant's Hoff equation and its application.

**Co 3.** Understand concept of ionisation processes, common ion effect, solubility product, buffer solutions and pH scales.

**Paper-II: Organic Chemistry**

**Sem- I**

On completion of the course F.Y B.Sc. student will able to

**Co 1.** Understand the fundamental principles and recent developments in subject area.

**Co 2.** Be inspired and develop interest towards chemistry as the main subject.

**Co 3.** Familiar with the current and recent development in Chemistry and research and development in chemistry.

**Paper-III: Chemistry Practical**

**Sem- I**

On completion of the course F.Y B.Sc. student will able to

**Co 1.** Aware the importance of chemical safety and lab safety while performing experiments in laboratory.

**Co 2.** Understand the determination of thermochemical parameters and related concepts.

**Co 3.** Understand the technique of pH measurements.

**Co 4.** Prepare the buffer solutions.

**Co 5.** Analyse the elements of organic compounds.

**Co 6.** Understand chromatographic techniques for separation of constituents of mixtures.

**Paper-I: Inorganic Chemistry**

**Sem- II**

On completion of the course F.Y B.Sc. student will able to

**Co 1.** Understand theories and principles applied to atomic structure, quantum mechanics and related important Schrodinger equation with radial and angular wave functions.

**Co 2.** Understand the properties in details regarding effective, atomic and ionic size, crystal and covalent radii, ionisation energies, electro negativity and it's scale.

**Co 3.** Understand attainment of stable electronic configurations, various types of chemical bonds, lattice and solvation energy, Born – Haber cycle its application Fajan's rule, dipole moment and percentage ionic character, hybridization, VSEPR theory, geometry of compounds.

### **Paper-II: Analytical Chemistry**

#### **Sem- II**

On completion of the course F.Y B.Sc. student will able to

**Co 1.** Understand analytical chemistry , perspective of analytical chemistry, analytical problems.

**Co 2.** Understand various methods of expressing concentrations with their units and their methods of calculation which will be helpful for preparation of solution, relation between molecular formula and empirical formula, stoichiometric calculations, equilibrium concentration and percent concentration, SI unit, distinction between mass and weight.

**Co 3.** Understand the determination of type, characteristic tests and classifications, reactions of different functional groups with elements detection and purification of organic compounds.

**Co 4.** Understand basics of chromatography and types of chromatography, theoretical background for paper and thin layer chromatography.

**Co 5.** Understand measurement of pH, electrodes for measurement of pH, application of pH meter.

### **Paper-III: Chemistry Practical**

#### **Sem- II**

On completion of the course F.Y B.Sc. student will able to

**Co 1.** Understand Inorganic Estimations using volumetric analysis.

**Co 2.** Understand Synthesis of inorganic compounds.

**Co 3.** Understand Analysis of commercial products.

**Co 4.** Purify organic compounds.

**Co 5.** Understand preparation and mechanism of reaction mechanisms.

# **S. Y. B.Sc outcome**

## **Paper-I: Physical and Analytical Chemistry**

### **Sem- I**

On completion of the course S.Y B.Sc. student will able to

#### **Section I**

**Co 1.** Understand concept of Kinetics rate laws,, techniques used for measurement of rate of reaction. different order of reactions with examples, Pseudo molecular reactions , Factors affecting on rate of reaction

**Co 2.** Understand about photochemistry, basic knowledge of photochemistry, difference between thermal and photochemical reactions, laws of photochemistry, quantum yield and it's measurement Types of photochemical reactions and photophysical process, Know about quenching and chemiluminescence how to solve numericals.

**Co3.** Understand the Concept of distribution of solute amongst pair of immiscible solvents, Distribution law and it's thermodynamic proof. Distribution law and nature of solute in solution state application of solvent extraction and numerical.

#### **Section II**

**Co 4.** Understand Analytical Chemistry, basics of analytical chemistry, Chemical analysis and its applications, Sampling, Common techniques, Instrumental methods and other techniques, Choice of method.

**Co 5.** Understand, errors and its interpretation Meaning of error and terms related to expression & estimation of errors , Methods of expressing accuracy and precision , Classification of errors, Significant figures and computations, Distribution of errors, Mean and standard deviations, Reliability of results.

**Co 6.** Understand inorganic Qualitative Analysis, basic principles in qualitative analysis, meaning of common ion effect, role of common ion effect and solubility product. Different groups for basic radicals group reagents and precipitating Interfering anions and its removal, Separation for basic radicals, Method of detection of acidic radicals.

**Co 7.** Understand the classification of compounds with different functional groups, different tests for detection of elements like C, H, (O), N, S & P, Characteristic tests for different functional groups, Different colour tests and the reactions Quantitative analysis of C, H by Liebig's method Kjeldahl's method with example, Carius tube method with example, Empirical and molecular formula, To solve numericals.

## **Paper-II: Organic and Inorganic Chemistry**

### **Sem- II**

On completion of the course, **S.Y B.Sc.** student will able to

## Section I

**Co 1.** Understand to identify chiral centre in the given organic compounds, Erythro, threo, meso, diastereoisomers with suitable examples, R/S configuration in compounds containing two chiral centres, Bayer's strain theory, Heat of combustion and relates stability of cycloalkanes, boat and chair configuration of cyclohexane, draw axial and equatorial bonds in cyclohexane, structure of conformations of mono- & disubstituted cyclohexane, stability of axial and equatorial conformation of monosubstituted cyclohexane.

**Co 2.** Define and classify heterocyclic compounds, use of Huckel rule for aromaticity, Suggest synthetic route for preparation of various heterocyclic compounds Write and complete various reactions of heterocyclic compounds. Predict products.

## Section II

**Co 3.** Understand principles and process of metallurgy, difference between ore and minerals, calcination and roasting and smelting, different methods for separation of gangue or matrix from metallic compounds, flux.

**Co 4.** Understand physico-chemical principles involved in electro metallurgy, electrolysis of alumina and its refining, uses of Aluminium and its alloys, purification of bauxite ore.

**Co 5.** Understand pyrometallurgy and physico-chemical principles involved in the reduction process by carbon monoxide, different reactions in the blast furnace, differentiate between properties of pig iron and wrought iron, basic principles of different methods for preparation of steel, merits and demerits of different methods.

**Co 6.** Understand corrosion types and mechanism of corrosion, factors affecting corrosion, Methods of prevention of metal from corrosion, meaning and different theories of passivity, Galvanising, Tinning, Electroplating from corrosion.

## Paper-I: Physical and Analytical Chemistry

### SEM II

On completion of the course S.Y B.Sc. student will able to

## Section I

### Physical Chemistry

**Co 1.** Understand free energy, types and its variation for chemical reactions and physical transition

Gibb's Helmholtz equations and its properties & significance Van't Hoff reaction isotherm and thermodynamic equilibrium constants, Chemical and physical equilibrium Clausius – Clapeyron equation and its application constant and to solve the problem.

**Co 2.** Understand to distinguish behaviour of liquid phase solutions, ideal and Non ideal solutions, v-p and temperature composition diagram, Distillation from temperature – composition diagram, Azeotropes, Partially immiscible liquids, to solve the problem .

## Section II

### Analytical chemistry

**Co 3.** Understand equivalent weight, molecular weight, normality, molality, primary and secondary standard, methods of expressing concentration, preparation of standard solution, calibration of apparatus, types of instrumental and non instrumental analysis.

**Co 4.** To learn and equip with non instrumental volumetric techniques, role of indicator, mixed and universal indicators, neutralization curves for various acid base titration, Know principle of complexometric precipitation and redox titrations, iodometry and iodimetry, standardization of sodium thiosulphate and EDTA, Reactions between  $\text{CuSO}_4$  and Iodine and liberated  $\text{I}_2$  and  $\text{Na}_2\text{S}_2\text{O}_3$ , Choice of suitable indicator, Estimate copper from  $\text{CuSO}_4$  and available chlorine in bleaching powder, Preparation of standard silver nitrate solution, Mohr's and Fajan's method.

## Paper-II: Organic and Inorganic Chemistry

### Sem-II

On completion of the course, S.Y B.Sc. student will able to

#### Section I

**Co 1.** Concept of different reagents used in the one type of conversion ii) Merits & demerits of different reagents iii) Reagent based mechanisms iv) Use of different hydrogen donors for hydrogenation

**Co 2.** Understand heterocyclic compounds, Huckel rule to predict aromaticity, synthetic route for preparation of various heterocyclic compounds, write and complete various reactions of heterocyclic compounds.

**Co 3.** Understand different biomolecules, role of biochemistry in the day to day life, importance of biochemistry, carbohydrates, classification of carbohydrates with example complete various reactions of glucose, optical activity in carbohydrates, Killani Fischer synthesis, stereoisomerism in monosaccharide, structure of some common aldoses and ketoses, diastereomers and epimers, cyclic structure of glucose in Fischer, Haworth and chair form, phenomenon of mutarotation, Draw the structure and bonding in maltose, lactose, cellobiose and sucrose, polysaccharide-structures of starch and cellulose, naturally occurring amino acids, important reactions of  $\alpha$ -amino acids, hydrogen bonding in  $\alpha$ -helical structure, stability of  $\alpha$ -helical chain and their R-groups, primary, secondary, tertiary and quaternary structure of proteins

#### Section II

**Co 4.** Understand the position of d-block elements in periodic table, general electronic configuration & electronic configuration of elements, periodic properties of these elements w.r.t. size of atom and ions, reactivity, catalytic activity, oxidation state, complex formation ability, colour, magnetic properties, non stoichiometry, density, m. p and B. p.

**Co 5.** Understand the metal carbonyl complexes and their uses in the homogenous catalysis, M-C bond, organometallic compounds, multiple bonding due to CO ligand, methods of synthesis of binary metal carbonyls, valence electron count (18 electron rule), catalytic properties of binary metal carbonyls, uses of organometallic compounds in the homogenous catalysis.

**Co 6.** Understand different solvents and different theories of acids and bases, Arrhenius theory Lowery- Bronsted concept, Lewis concept, merits and demerits of different theories of acids and bases, conjugate

## **T.Y.B.Sc outcome:**

### **SEM III**

#### **Physical Chemistry:**

**CO1:** Understand Mechanics of system of particles

**CO2:** Know the Redox reaction and study the Crystal Field Theory

**CO3:** Understand De-Broglie hypothesis and Uncertainty principle

**CO4:** Derive Schrodinger's time dependent and independent equations

#### **Inorganic Chemistry:**

**CO1:** Understand different operation in stoichiometric molecule.

**CO2:** Understanding the electronic configuration of lanthanides and actinides.

**CO3:** Understand different operation in stoichiometric molecule.

#### **Organic Chemistry:**

**CO1:** understanding of: how to calculate limiting reagent, theoretical yield, and percent yield

**CO2:** Understanding of how to engage in safe laboratory practices by handling laboratory glassware, equipment, and chemical reagents appropriately

**CO3:** Understanding of how to dispose of chemicals in a safe and responsible manner

**CO4:** Understanding of how to dispose of chemicals in a safe and responsible manner

#### **Analytical Chemistry:**

**CO1:** Understanding the principles and applications of modern chemical instrumentation, experimental design, and data analysis

**CO2:** Understanding the the underlying chemical and physical of instrumental methods of analysis, including electronic and vibrational spectroscopy, reaction kinetics, chemical separation methods, and mass spectrometry

**CO3:** Understanding formulating and solving problems in the laboratory

**CO4:** Understanding of how to work with others as part of a team to solve scientific problems

### **Industrial Chemistry:**

**CO1:** Know the various pharmaceutical drugs, their application and synthesis

**CO2:** To understand the function of dyes, paints and pigments.

**CO3:** Conceptual understanding of molasses and bagasse

### **Introduction to Biochemistry and Molecular Biology**

**CO1:** Know and follow the proper procedures and regulations for safe handling and use of chemicals.

**CO2:** Understand the objective of their chemical experiments, properly carry out the experiments, and appropriately record and analyze the results.

**CO3:** Use standard laboratory equipment, modern instrumentation, and classical techniques to carry out experiments.

**CO4:** Identify the metabolic pathway of macro molecules.

## **SEM IV**

### **Physical Chemistry:**

**CO1:** Understand Mechanics of system of particles.

**CO2:** Understand De-Broglie hypothesis and Uncertainty principle

**CO3:** Understanding how to Solve the cell reaction and calculate EMF..

### **Inorganic Chemistry:**

**CO1:** Understand different operation in stoichiometric molecule.

**CO2:** Understand the p-type semiconductor and n-type semiconductor

**CO3:** Conceptual Understanding of Bio-inorganic chemistry

### **Organic Chemistry:**



**CO1:** Understanding the identity, purity, and percent yield of products and to summarize findings in writing in a clear and concise manner

**CO2:** understanding of the general reactivity of functional groups and mechanism

**CO3:** Understanding how to characterize products by physical and spectroscopic means including MP, IR, NMR, GC, and MS

**CO4:** Understanding how to use the scientific method to create, test, and evaluate a hypothesis

### **Analytical Chemistry:**

**CO1:** understanding of different types of separation techniques.

**CO2:** Understanding of principle, construction and working of GC and HPLC.

**CO3:** To give an extended knowledge about chromatographic

**CO4:** Discuss the problem based on distribution coefficient and extraction techniques.

### **Industrial Chemistry:**

**CO1:** To understand the function of dyes, paints and pigments.

**CO2:** Know the various pharmaceutical drugs, their application and synthesis.

**CO3:** To know about molasses and bagasse

### **Introduction to Biochemistry and Molecular Biology:**

**CO1:** Understand the chemistry of water.

**CO2:** Understanding the chemistry of enzymes.

**CO3:** Understanding the chemistry of carbohydrates, lipids, proteins and nucleic acids.

**CO4:** Identify the metabolic pathway of macro molecules.