# Bachelor of Science (B.Sc.)

## Department of Chemistry

## Programme Outcomes (POs)

**After completing B.Sc. degree programme, the students will be able to:**

**PO1:** Offer theoretical as well as practical knowledge about different special subject areas.

**PO2:** Understand the academic field to pursue multi and interdisciplinary science careers in future that include Chemistry, Physics, Botany, Zoology, Mathematics, Microbiology and Computer Science.

**PO3:** Plan and execute experiments or investigations, analyze and interpret data information collected using appropriate methods.

**PO4:** Develop scientific temper and attitude which is more beneficial for the society as the scientific developments and make a nation or society to grow at a rapid pace through research.

**PO5:** Think critically, follow innovations and developments in science and technology.

**PO6:** Understand the issues of environmental contexts and sustainable development.

**PO7:** Acquire the skills and ability to engage in independent and life-long learning in the broadest context socio technological changes.

**PO8:** Demonstrate professional and ethical attitude with enormous responsibility to serve the society.

## Programme Specific Outcomes (PSOs)

**PSO1:** Use the knowledge of Chemistry through theory and practical's.

**PSO2:** Identify the structure-activity relationship.

**PSO3:** Explain good laboratory practices and safety.

**PSO4:** Create the research-oriented skills.

**PSO5:** Use of sophisticated instruments/equipment's.

## Course Outcomes (COs)

After completion of these courses students should be able to;

**B. Sc. I Semester I**

**DSC-3A- Chemistry paper I (Inorganic Chemistry)**

**CO1:** Explian the Bohr's theory of hydrogen atom and its limitations, Wave particle quality, Heisenberg uncertainty principle, Quantum numbers and their significance, Shape of s, p and d atomic orbitals.

**CO2:** Describe a) Aufbau's principle b) Hunds rule of maximum multiplicity c) Pauli's exclusion principle.

**CO3:** Predict the Periodicity of the elements.

**CO4:** Relate the Chemical Bonding and Molecular structure

**CO5:** Discuss Valence bond theory (VBT).

**CO6:** Compare the Molecular orbital theory (MOT) and Valence bond theory (VBT).

**DSC-4A- Chemistry paper II (Organic Chemistry)**

**CO7:** Desribe Curved arrow notations, Cleavage of Bonds: Homolysis and Heterolysis Organicmolecular species: Nucleophiles and electrophiles. Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation effect

**CO8:** Explain Reactive Intermediates: Generation, Structure, Stability and Reactions of Carbocations, Carbanions and carbon free radicals.

**CO9:** Predict the Nomenclature of stereoisomers: D and L, erythro and threo, R and S, E and Z.

**CO10:** Discuss the Aromaticity concept and predict the Aromatic, Non aromatic, Antiaromatic, Pseudoaromatic compounds.

**CO11:** Relate the Cycloalkanes, cycloalkanes and alkadienes.

**CO12:**Describe a)Photohalogenation b) Catalytic halogenations c)Catalytic hydrogenation d) Effect of heat e) Reaction with hydrogen halide.

**B.Sc. I Semester II**

**DSC-4B-Chemistry Paper IV (Analytical Chemistry)**

**CO13:** Explain Analytical processes (Qualitative and Quantitative), Methods of analysis (Only classification), Sampling of solids, liquids and gases, Errors, types of errors.

**CO14:** Discuss the Basic Principle of Chromatography, Basic terms, Classification of Chromatography.
**CO15:** Comparison of paper chromatography and TLC
**CO16:** Outline of titrimetric Analysis such as Strong acid-strong base, Strong acid-weak base, Strong base-weak acid, Complexometric titrations.
**CO17:** Use and Applications Water Analysis.
**CO18:** Explain the Analysis of Fertilizers.

**Chemistry-DSC 3B: Chemistry Paper-III (Physical Chemistry)**
**CO19:** Expalin the First law of thermodynamics, Statements of second law of thermodynamics,Carnot's cycle and its efficiency, Statement of Third Law of thermodynamics
**CO20**: Solve the Problem based on thermodynamics
**CO21:** Discuss the Concept of standard state and standard enthalpies of formations, integral anddifferential enthalpies of solution and dilution.
**CO22:** Compare between $\Delta G$ and $\Delta Go$, Le Chatelier's principle. Relationships between Kp,Kc and Kx for reactions involving ideal gases.
**CO23:** Relate Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation.

**Ideal and Non ideal gases.**
**CO24:** Illustrate Deviation of real gases from ideal behaviour, compressibility factor, causes ofdeviation. Van der Waals equation of state for real gases.
**CO25:** Find the Derivation of Zero order reaction, first order reaction, Pseudo-unimolecularreactions, second order reaction.

**B.Sc. Part II (CBCS) Sem III**
**Paper No. DSC- C3 - Chemistry paper no. V (Physical Chemistry)**
**CO26:** Discuss Types of conductors, Conductivity, Equivalent and Molar conductivity and Their variation with dilution for weak and strong electrolytes in aqueous solution
**CO27:** Illustrate the conductance by using Wheatstone bridge. Kolharausch law of independentmigration of ions and its applications such as Ionic mobility, determination of degree ofionization of weak electrolyte, solubility and solubility products.
**CO28:** Describe all Physical Properties of Liquids and Third order reactions,derivation of rateconstant.
**CO29:** Explain the Adsorption as a surface phenomenon, Definition of adsorption, adsorbent,adsorbate, absorbent. Factors affecting adsorption, Types of adsorption
**CO30:** Compare between physical and chemical adsorption, Adsorption isotherms: Freundlichadsorption isotherm, Langmuir adsorption isotherm.
**CO31:** Outline of Types of Nuclear radiation, properties of $\alpha$, $\beta$ and $\gamma$ radiations, Detection andmeasurement of nuclear radiations by Scintillation and Geiger muller counter methods.

**Paper No. DSC-C4- Chemistry paper no. VI (Industrial Chemistry)**
**CO32:** Explain the Basic Concepts in Industrial Chemistry
**CO33:** Compare between classical chemistry and industrial chemistry.
**CO34:** Find the Normality, Equivalent weight, Molality, Molecular weight,Molarity, Molarityof mixed solution.
**CO35:** Describe the method of Size reduction- Principle, Jaw crusher, ball mill, Size

Enlargement Principle, Pellet mill, tumbling agglomerators.
**CO36:** Discuss the Theory of Corrosion and Elecroplating.
**CO37:** Use and Manufacturing Paper Industry and Soaps and Detergent

**B.Sc. Part II (CBCS) Sem IV**
**Paper No. DSC-D3- Chemistry paper no. VII (Industrial Chemistry)**
**CO38:**Describe the concept in Co-ordination chemistryCO-39.Compare between double salt and complex salt
**CO40:**Find the IUPAC nomenclature of coordination compoundsCO-41.Explain the Chelation, classification and its applications. CO-42.Outline of P- Block elements and its characteristics.
**CO43:** Discuss the Characteristics of d-block elements with special reference to i) Electronicstructure ii) Oxidation states, stability of oxidation states of Fe with respective to Latimer diagram iii) Magnetic character iv) Colored ions v) Complex formation.
**CO44:** Find the Application of complex formation

**Paper No. DSC- D4 - Chemistry paper no. VIII (Organic Chemistry)**
**CO45:** Explain the reaction and methods of Preparation of Carboxylic acids and their derivatives.
**CO46:** Describe the Classification, Nomenclature, structure, Methods of preparation and reactions of Amines and Diazonium Salts.
**CO47:** Compare the reducing and non-reducing sugars.CO-48.Discuss the Classification of carbohydrates.
**CO49:** Relate the Reactivity of Carbonyl group and categorize its reactions.
**CO50:** Outline of Representation of conformations of ethane by using Saw- Horse, Fischer(dotted line wedge) and Newmann's projection formulae and ethane and n-butane byNewmann's Projection formula.

**B. Sc III ChemistrySemester-I**
After completion of these courses students should be able to;
**Paper XI PhysicalChemistry**
**CO51:** Describe Heisenberg Uncertainty Principle, concept of energy operator, particle in one dimensional box.
**CO52:** Define Quantum theory, explain Schrodinger wave equation, emf measurement and its application.
**CO53:** Analyze electromagnetic spectrum, Raman Spectra compare and contrast rotational spectra, vibrational spectra, vibrational Raman spectra and rotational Raman spectra ofdiatomic molecule.
**CO54:** Write Photochemical Law's, reactions and various Photochemical Phenomena.
**CO55:** Classify solutions, relation vapour pressure temperature relations.
**CO56:** Compare between electrodes and cells.

**Paper IX InorganicChemistry**
**CO57:** Find the meaning of various terms involved in Acids and Bases.
**CO58:** Describes the shapes of d-orbitals.
**CO59:** Discuss the Applications of Semiconductor and Superconductors.
**CO60:** Predict the mechanism involved in Organometallic Chemistry.
**CO61:** Expalin the homogenous catalysis and heterogeneous catalysis.
**CO62:** Predict the degeneracy of d-orbitals.

**Paper X OrganicChemistry**

**CO63:** Describe the principle of UV Spectroscopy.
**CO64:** Impart the concept of vibrational Transitional region of IR Spectrum.
**CO65:** Illustrate the Structure of Unknown Organic compounds.
**CO66:** Compare between UV and NMR.
**CO67:** Explain the principle of mass spectroscopy.
**CO68:** Solve the problem based on UV, NMR and IR.

**Paper XII Analytical Chemistry**

**CO69:** Explain the Precipitation Techniques.
**CO70:** Discuss the applictions of organic precipitants.
**CO71:** Explain the Principle of flame photometry.
**CO72:** Design the experimental set up for flame photometry.
**CO73:** Describe the theory of Colorimetry and spectrophotometry.
**CO74:** Identify the concept of Quality control.
**CO75:** Categarised the different functional group based on Chromatography.

**B. Sc III ChemistrySemester-II**

**Paper XIII Inorganic Chemistry**

**CO75:** Explain SN 1 and SN 2 reactions for inert and labile complexes.
**CO76:** Describe the Thermodynamic and Kinetic aspects of metal complexes.
**CO77:** Discuss the Nuclear reactions and energetic of nuclear reactions.
**CO78:** Use of Thorium, Uranium and Plutonium in atomic energy.
**CO79:** Compare between lanthanide and actinides.
**CO80:** Predict Biological role of alkali and alkaline earth metal ions with special reference to Na+, K+ and $Ca^{2+.}$

**Paper No. XIV Organic Chemistry**

**CO81:** Use and application Lithium aluminium hydride LiAlH4, Raney Nickel,Osmium tetraoxide, Selenium dioxide (SeO2),Dicyclohexyl Carbodiimide (DCC), Diazomethane.
**CO82:** Explain the Diels -Alder reaction, Meerwein –Pondorff-Verley reduction, Hofmann rearrangement, Wittig reaction,Wagner- Meerwein rearrangement, Baeyer Villiger oxidation.
**CO83:** Discuss the Retrosynthesis of different Molecules.
**CO84:** Describe Electrophilic addition to >C=C< and −C≡C− bonds.
**CO85:** Solve the problem based on addition reaction.
**CO86:** Inpart the concept of Anti-Markovnikoff's addition.
**CO87:** Explain Synthesis and uses of ethambutal, phenobarbitone, isoniazide, benzocaine, Chloramphenicol, paludrine.
**CO88:** Outline the biogenesis of Alkaloids,Terpenoids.

**Chemistry Paper No. XV (Physical Chemistry)**

**CO89:** Discuss Gibbs phase rule, Phase diagram, true and metastable equilibria.
**CO90:** Compare one component systems and two component systems.
**CO91:** Describe the concept of Thermodynamics and its applications
**CO92:** Explain the different State of solid, Laws of crystallography, Weiss indices and Millerindices.
**CO93:** Solve the Numerical problems based on Derivation of Bragg's equation.

**CO94:** Predict the Simultaneous reactions such as Opposing reaction, Side reaction,Consecutive reactions, Chain reaction, Explosive reaction.

**Paper No. XVI (Industrial Chemistry)**

**CO95:** Discuss Manufacture of cane sugar in India: Extraction of juice, Clarification, Concentration, crystallization, centrifugation and other details of industrial process.

**CO96:** Explain the Manufacture of Industrial Heavy Chemicals.

**CO97**: Describe the use, Classification and applications of Synthetic Polymers.

**CO98:** Categorized the different term involved in nanotechnology.

**CO99:** Impart the role of Petroleum industry and eco-friendly fuels.

**CO100:** Identify the concept of Nanotechnology.