



Mahatma Gandhi Vidyamandir's

**Loknete Vyankatrao Hiray Arts, Science and Commerce College,  
Panchavati, Nashik-422003**

(Affiliated to SPPU, Pune, Reaccredited with 'A' grade, Recipient of Best College Award by SPPU)

**Programme Specific Outcomes,**

**&**

**Course Outcomes of B.Sc**

**Department of Chemistry**

**Academic Year**

**2021-22**

## Programme Specific Outcomes: B.Sc. Chemistry (USC)

Name of the Department: Chemistry

### Program Specific Outcomes

At the end of the programme, student will be able to

1	learn the basic terms, theories, principles of chemistry and of its different sub-subjects.
2	identify and analyse problems and issues with well-defined solutions.
3	get the hands-on training of the chemistry related equipment's.
4	use modern techniques, software's and web resources
5	create an awareness about the impact of chemistry on the environment, in and outside the scientific society.
6	know the safety rules of chemistry required for working in and outside the laboratory

## Course Outcomes: F.Y.B.Sc. Chemistry (USC)

Semester-I		
Paper	Course code and course title	At the end of the course, student will be able to
I	USC(CH-101) Physical Chemistry	Remember laws of thermodynamics and chemical and ionic equilibria
		Understand terms involved in thermodynamics, chemical and ionic and equilibria
		Develop various equations of thermodynamics and chemical and ionic equilibria
		Apply the formulae to solve the numerical based on thermodynamics, chemical and ionic and equilibria
		Give applications of laws and their limitations.
		Access various chemical and physical processes in terms of concepts of thermodynamics and chemical and ionic equilibria
II	USC(CH-102) Organic Chemistry	Define Physical Effects, Electronic Displacements: Inductive Effect, Electrometric Effect, Resonance and Hyperconjugation.
		Understand the fundamentals, principles, and recent developments in the subject area.
		Interpret R/S, E/Z Configurations of organic compounds.
		Explain Interconversion of Wedge Formula, Newman, Sawhorse and Fischer representations. Conformations concerning ethane, butane and cyclohexane.
		Develop a method for the preparation of alkane, alkene, and alkyne.
		Create the foundation for research and development in Chemistry.
III	USC(CH-103) Chemistry Practical Course I	Define pH, enthalpy of ionization, heat capacity.
		Discuss thermochemical parameters and related concepts.
		Calculate R <sub>f</sub> values.
		Organic qualitative analysis.
		Discriminate safety symbol.
		Make buffer solutions.
Semester-II		
		Define various types of chemical bonds- Ionic, covalent, coordinate and metallic bond
		Discuss Block, group, modern periodic law and periodicity, stability of half-filled and filled orbitals.

IV	USC(CH-201): Inorganic Chemistry	understanding of Atomic Structure, geometry and effect of lone pairs with examples such as $\text{ClF}_3$ , $\text{Cl}_2\text{O}$ , $\text{BrF}_5$ .
		Design a Skeleton of the long form of the periodic table.
		Interpret the concept of different types of valence shell electron pairs and their contribution to bonding
		Application of non-bonded lone pairs in the shape of the molecule
V	USC(CH- 202): Analytical Chemistry	Remember various terms involved in analytical chemistry
		Understand separation, purification and identification techniques of analytical chemistry.
		Apply various formulae to solve analytical problems.
		Discuss basics of chromatography and types of chromatography.
		Explain instrumentations of pH-metry.
		Know and explain the applications of chromatography and pH-metry
VI	USC(CH-203) Practical Chemistry Course II	Define crystallization, distillation.
		Estimate $\text{Cu(II)}$ from brass alloy by iodometrically.
		Sketch of polar plots of S and P Orbital.
		Analysis of commercial products.
		Discriminate between oxime derivative and DNP derivative.
		Make Inorganic pigment cuprous oxide ( $\text{Cu}_2\text{O}$ ).

## Course Outcomes: S.Y.B.Sc. Chemistry (USC)

Semester-III		
Paper	Course code and course title	At the end of the course, student will be able to
I	USC(CH-301) Physical and analytical chemistry	Define the terms related to Chemical kinetics, surface chemistry, errors in quantitative analysis and volumetric analysis.
		Explain the concepts of Chemical kinetics, surface phenomenon, errors, organic and inorganic qualitative analysis.
		Solve the numerical problems based on the subject physical and analytical chemistry.
		Differentiate the chemical reactions, errors in analysis, qualitative and quantitative analysis.
		evaluate the rate equation, Nernst distribution law, Lambert's Beers Law and different analysis methods.
		Justify the chemical reaction, terms of surface chemistry, error in analysis, the qualitative and quantitative methods of analysis.
II	USC(CH-302) Inorganic and Organic chemistry	Define terms related to MOT, coordination compound, Hydrocarbons.
		Explain the terms LCAO principle, types of MO's.
		Recognize functional groups and their reactions, addition reaction, nucleophilic substitution, elimination reaction.
		Apply reaction mechanism to predict the products of the reaction in SN1, SN2, E1, E2, rearrangement reaction. Apply rules of absolute configuration and will predict the configuration at chiral C atom.
		Decide whether the reaction SN1, SN2, E1, E2 Reaction.
Plan for the synthesis of Alcohol, Ether, and Phenols.		
III	USC(CH-303) Practical chemistry	Determine the rate of reaction experimentally
		Analysis of organic and inorganic compound qualitatively
		Students able to make solutions of different concentrations
		Synthesis of organic and Co-ordination compounds
		Uses of pH metry, Conductometry, Colorimetry.
Demonstrate Volumetric analysis, ideal and real solutions, adsorption and organic estimation		
Semester-IV		

IV	USC(CH-401) Physical and Analytical Chemistry	Define terms such as Phase equilibrium, Ideal solution. Real solution, conductometry colorimetry and column chromatography.
		Explain the terms such as phases, components, solution, conductance, resistance, transmittance, absorbance and different chromatography methods.
		Predict the Gibbs phase rule, Raoult's law, Henry's Law Ohm's law, Kohlrausch's law, Lambert's law and Beer's law.
		Calculate the numerical problems based on theory/equations.
		Justify the different laws of phases, solution, conductometry colourimetry and different chromatography methods.
		Compile the all the principles, laws and other information according to their understanding.
V	USC(CH-402) Inorganic and Organic chemistry	Draw the structure and stability of different conformations of Cyclohexane and substituted cyclohexane
		Discuss the preparation, physical and chemical properties of amines, carboxylic acid, Aldehyde and ketones.
		Apply Valence bond theory, crystal field theory and molecular orbital theory to different types of complexes.
		Explain Isomerism in coordination complexes.
		Calculate field stabilization energy and magnetic moment for various complexes.
		Plan for interconversion of different functional groups.
VI	USC(CH-403) Practical Chemistry	Determine cell constant, dissociation constant and perform conductometric titrations
		Perform column chromatography for separation of binary mixture of cations
		Determine percent concentration for the phenol water system and study the effect of added electrolyte on the critical solution temperature of phenol-water system.
		Verify the Freundlich and Langmuir adsorption isotherm for adsorption of acetic acid on activated charcoal
		Perform organic and coordination compounds synthesis.

		Apply Beer's law and calculate absorbance of unknown concentration solution.
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## Course Outcomes: T.Y.B.Sc. Chemistry (USC)

Semester-V		
Paper	Course code & course title	At the end of the course, student will be able to
I	USC(CH-501) Physical Chemistry-I	Understand and explain the differences between classical and quantum mechanics
		Discuss various laws and theories of quantum chemistry and solve the problems.
		Know and explain the theory and applications of microwave, IR and Raman spectroscopy.
		Draw rotational, IR and Raman spectra.
		Explain various concepts and laws of photochemical reactions.
		Apply photochemical concepts to solve the problems.
II	USC(CH-502) Analytical Chemistry I-	Define basic term in gravimetry, spectrophotometry, qualitative analysis, parameters in instrumental analysis, UV-Visible spectroscopy.
		Identify important parameters in analytical process.
		Explain different principles involved in the gravimetry, spectrophotometry, parameters in instrument analysis, qualitative analysis.
		Describe procedure for different types of analysis included in the syllabus.
		Demonstrate theoretical principles with the help of practical
		Compare the different analytical term, process and analytical methods.
III	USC(CH-503) Physical Chemistry Practical I	Prepare the solutions of various concentrations and interconvert the them.
		Explain the principles involved in Refractometry, Spectrophotometry and Colorimetry, Conductometry, Viscosity and Photofluometry
		Construct the experimental set up.
		Demonstrate the experiments.



		Analyse the observations
		Calculate and discuss the obtained results.
IV	USC(CH-504) Inorganic Chemistry I	Define Nephelauxetic Effect, Trans Effect, Boiling Point and Melting Point.
		Explain Electroneutrality Principle and Different Type of Pi Bonding, MOT of Octahedral Complexes with Sigma Bonding, Electronic Configuration Of Lanthanide And Actinide.
		Classify Metallic Bond on The Basis Of Band Theory, Insulator On The Basis Of Band Theory, Separation Of Lanthanides By Modern Method.
		Difference Between Metal, Semiconductor and Insulator, Na, Mg, AL In Term of Valence Electron & conductivity, lanthanides and actinides.
		Evaluate the Trends in Periodic Properties of These Elements Lanthanide Contraction, Electrical Conductivity Of Metals With Respect To Valence Electrons
		Design Inorganic Reaction Mechanisms Available in The Literature to Solve Chemical Problems, N(E) AND N(E) Curve,
V	USC(CH-505) Industrial Chemistry	know the importance and requirements of the chemical, sugar, fermentation, soap, detergents, dyes, and pigment industry.
		describe the industries according to their raw material, application and products.
		apply the knowledge of industrial chemistry for the real-life situations.
		categorize the industries according to their working principle, processes, products and applications.
		assess the industries according to their products, its applications and safety measures.
		develop the flowsheet or plan of industrial processes.
VI	USC(CH-506) Inorganic Chemistry	List of quantitative and qualitative analysis.
		Understand the purpose of collecting, interpreting, analysing, and reporting (in written form) chemical data.

	Practical-I	Explain Mole concept and its application in the preparation of normal and molar solutions, and use of mole concept in quantitative calculations for inorganic analysis
		Decide methods and instruments that can be used qualitative and quantitative analysis.
		Create proper quantitative methods for analysis of samples containing inorganic substances
		Perform all the activities in the laboratory with neatness and cleanness
VII	USC(CH-507) Organic Chemistry –I	Identify types of reactions; electrophilic and nucleophilic substitution, rearrangement and elimination reactions.
		Write reaction mechanism involved electrophilic and nucleophilic substitution, rearrangement and elimination reactions.
		Discuss the synthetic applications of active methylene compounds, rearrangement and elimination reactions.
		Explain factors affecting the reactivity of compounds in active methylene compound reactions, rearrangement and elimination reactions.
		Write the structures of reactants and products of reactants.
		Solve the problems based on active methylene compounds, rearrangement and elimination reactions.
VIII	USC(CH-508) Chemistry Of biomolecule	Give introduction to molecular logic of life.
		Define Carbohydrates, Lipids, Amino acids, Proteins, Enzymes and Hormones
		Classify Carbohydrates, Lipids, Amino acids, Proteins, Enzymes and Hormones
		Discuss the properties of Carbohydrates, Lipids, Amino acids, Proteins, Enzymes and Hormones
		Describe the importance of biomolecules
		Explain reactions of Carbohydrates, Lipids, Amino acids, Proteins, Enzymes and Hormones
IX	USC(CH-509) Organic	Develop skills required in chemistry such as the appropriate handling of apparatus and chemicals.

	Chemistry Practical-I	Design the experimental set up and perform organic qualitative analysis, organic preparations and green chemistry experiments.
		Write the reaction mechanisms.
		Separate, purify and confirm the formation of the compounds.
		Describe the various techniques of synthesis and analysis of organic compounds.
		Analyse and interpret the experimental results.
X	USC(CH- 510B) Polymer Chemistry	Define monomer, polymer, polymerisation, degree of polymerisation, functionality
		Understand Various ways of nomenclature.
		Relate Different schemes of classification of polymers, polymer nomenclature, molecular forces and chemical bonding in polymers, glass transition temperature of polymer.
		Difference between simple compounds and polymer.
		Judge Mechanisms of polymerization.
		Rewrite application of the following polymers: polyethylene, polystyrene, polyvinyl chloride, polyvinyl alcohol, polymethyl methacrylate, polytetrafluoroethylene, polyamides, polyesters, phenol formaldehyde resins (Bakelite, Novolac), silicone polymers, polyisoprene, conducting Polymers.
XI	USC(CH- 511A) Environmental Chemistry	Describe the term involved in environmental chemistry, hydrosphere and water pollution, analytical technique in water analysis and water pollution and treatment methods.
		Explain hydrological cycle, Segment of environment, biochemical cycles, different analytical technique in water analysis, water pollutant, eutrophication, waste water treatment.
		Compare water quality parameters, different technique in water analysis and waste water treatment methods.
		Classify water pollutant, environment pollution, waste treatment methods
		Write different techniques in water analysis and waste water treatment method.

		Draw hydrological cycle, different waste treatment process, biochemical cycle.
<b>Semester-VI</b>		
I	USC(CH-601) Physical Chemistry II	Recall the various terms related to electrochemistry, crystallography, and nuclear chemistry.
		Demonstrate electrochemical cell, reference electrode, EMF, Isotropy, anisotropy, unit cell and radioactivity.
		Classify reversible and irreversible cells, Primary and secondary Reference Electrodes, radioactive nuclides.
		Draw electrochemical cells, primary and secondary reference electrodes, crystal structure.
		Evaluate the electrochemical cells, titrations methods, Batteries, crystal structures and nuclear reactions.
		Prepare list of electrochemical cells, Batteries, crystalline and amorphous substances, radioactive reactions.
II	USC(CH-602) Physical Chemistry III	Remember the general terms of colligative properties, Kinetics, electronic structure and polymers.
		Explain the various techniques used to explain colligative properties.
		Understand and apply kinetic laws of solid-state reactions.
		Analyse the band structures conductors, semiconductors and insulators.
		Classify the types of polymers
		Determine the molecular weights of polymers.
III	USC(CH-603) Physical Chemistry Practical-II	Prepare the solutions of various concentrations and interconvert the them.
		Explain the principles involved in potentiometry, pH metry and Radioactivity, Colligative properties, and Turbidometry
		Construct the experimental set up.
		Demonstrate the experiments.
		Analyse the observations.
		Calculate and discuss the obtained results.

IV	USC(CH-604) Inorganic Chemistry-II	Define Organometallic Chemistry, Homogeneous and Heterogeneous Catalysis, Bioinorganic Chemistry, Inorganic Polymer.
		Understand The M-C Bond, Multiple Bond Due to Co Ligand, Phenomenon Of Catalysis, Its Basic Principle And Terminologies, Essential The Role Of Metals In Non Enzymatic Processes, Technological Importance Of Ionic Solids. Catalytic Reactions for Wilkinson's Catalysis, Hydroformylation Reaction.
		Draw the Structure of Vit.B12 And Give Its Metabolism, Catalytic Cycle, Silicones, Siloxanes, Borazines, Phosphazenes
		Explain catalytical Activities of Binary Metal, Accounts of Homogeneous and Heterogeneous Catalysis, Function of Haemoglobin and Myoglobin in O <sub>2</sub> transport And Storage, Types of Inorganic Polymer, Inorganic Liquid Crystal.
		Evaluate the Uses of Organometallic Compounds in The Homogeneous Catalysis, Use of Catalysis in Industries Area, Biological Role of Inorganic Ions and Compounds, Uses of Inorganic Polymer, Technological Importance of Ionic Liquids.
		Design the Chemistry of Ferrocene, of Olefins, Zeolites In Catalysis Biodiesel Synthesis, Automotive Exhaust Catalysis., Structure And Bonding Using Valance Electron Count, Metalloprotein Of Iron, Synthesis Structural Aspects Of Inorganic Polymer, Ionic Liquid, Their Preparation and Their Significant W.R.T. Green Chemistry.
V	USC(CH-605) Inorganic Chemistry-III	Define Acid and Bases, Crystalline Amorphous Solid, Ionic Radius, Lattice Energy, Zeolites, Nano chemistry, Chemical Toxicology.
		Explain Theories of Acids, Nature of Solids, Defects in Solids, Zeolite Synthesis and Their Structure, Various Method of Nanoparticle Synthesis, Impact of Toxic Chemical on Enzyme
		Illustrate the Strength of Various Types of Acids, Crystal Structure of Solids, Haber Cycle, Zeolite Framework Type and Their Classification, Properties and Application of Nanoparticle, Impact of Toxic Chemical in The Enzyme.

		Compare Acid Base Strengths in Non-Aqueous Solvents, Frenkel And Schottky Defect, Natural and Artificial Zeolites, Biological Effect of As, Cd, Pb, Hg
		Evaluate the Different Properties If Acid and Bases, Types of Voids, Application of Zeolites, Application of Nano chemistry, Biological Methylation.
		Write the Hard and Soft Acid and Base Concept with Example, Coordination Number of Ions in Ionic Solids, Stabilization of Nanoparticle in Solution
VI	USC(CH-606) Inorganic Chemistry Practical-II	Define the Following Term Column Chromatography, Nano catalyst,
		Understand the Solvent Free Microwave Assisted One Pot Synthesis
		Apply Column Chromatography for Purification Of Water Using Cation/Anion Exchange Resin.
		Analyse Different Ion by Using Volumetric Method, Or Flame Photometry.
		Create Proper Quantitative Methods for Analysis of Samples Containing Inorganic Substances
		Perform All the Activities in The Laboratory with Neatness and Cleanness
VII	USC(CH-607) Organic Chemistry-II	Define spectroscopy
		Interpret the UV, IR and PMR spectra.
		Describe the principles of UV, IR and PMR spectroscopy.
		Solve the problems based on UV, IR and PMR spectroscopy.
		Determine the structure of simple organic compounds on the basis of spectral data such as $\lambda$ max values, IR frequencies, chemical shift
		Explain the geometrical isomerism, stability, energy calculations and optical activity of in disubstituted cyclohexane's and decalins.
VIII	USC(CH-608) Organic Chemistry-III	Understand the concepts involved in retrosynthetic analysis, reagents, Wolff rearrangement, Hofmann rearrangement, Simmons-Smith reaction, Michael reaction, Wittig reaction, McMurry reaction, Diels-Alder reaction, etc, natural products.

		Write reaction mechanism.
		Apply concepts of organic synthesis.
		Identify the structures of reactants and products.
		Explain classifications, isolations and structural determination of terpenoids and alkaloids.
		Discuss the synthesis of citral and ephedrine.
IX	USC(CH-609) Organic Chemistry Practical-II	Interpret IR and NMR spectra
		Achieve the practical skills required to perform the estimation, organic extractions, and column chromatography.
		Describe the principles involved in estimation, organic extractions, and column chromatography.
		Apply the principles of estimation, organic extractions, and column chromatography.
		Design the experimental set up to perform the experiments of organic estimation, organic extractions and purification using column chromatography.
		Analyse and explain the experimental results
X	USC(CH-610A) Introduction of Forensic Chemistry	Define the term in history of development of forensic science in India, introduction of narcotics drugs and psychotropic substances.
		Explain the methods of identifying of narcotics, drugs and psychotropic substance.
		Classify narcotics and psychotropics drugs.
		Analysis of narcotics drugs and psychotropic substances
		Fundamental principles and functions of forensic science.
		Testing of narcotics drugs and psychotropic substances.
XI	USC(CH-611B) Analytical Chemistry –II	Discuss Techniques of solvent extraction, Types of chromatography.
		Explain different principles involved in the analyses using solvent extraction, basics of instrumental chromatography, HPLC, GC, and atomic spectroscopic techniques.
		Apply different Technique for purification of organic and inorganic compounds

		Differentiate among the different analytical terms, process and analytical methods.
		Use of AAS and FES as an analytical tool.
		Solve the numerical problems.