

COURSE OUTCOMES
SUBJECT - CHEMISTRY

F. Y. B.Sc.	
SEM-I	
PAPER 1	Course Title: Chemistry Paper I Course Code: USCH101
CO1	The main objective of the course is Knowledge inclusion in students by conducting theory lectures on Chemical Thermodynamics and Chemical calculations. By studying chemical thermodynamics Students acquired knowledge about the correlation between chemical energy and work considering various systems at different temperatures and pressures. By studying chemical calculations students learned about stoichiometry and methods of expressing concentration of solution.
CO2	The learner will be able to understand the basic concepts of inorganic chemistry like structure of atom, electronic configuration & its related concepts
CO3	The learner will be able to understand periodic table and periodic properties like atomic size, ionization Potential, electron affinity & electronegativity
CO4	The learner will be able to write the names of mono bifunctional aliphatic compounds including their cyclic analogues. Draw the structure of organic compounds based on systematic names
CO5	Comprehend the fundamental concepts which govern the structure, bonding & hybridization, bond angles and shapes of the molecules. The learner will know the concept of electronic effects, understand the importance of reaction intermediates.
PAPER 2	Course Title: Chemistry Paper II Course Code: USCH102
CO1	On completion of this topic on Chemical Kinetics , students will be able to understand the concept of Rate of chemical reaction and factors affecting the rate of reaction. They will be able to calculate and conclude about the order of given reaction. Different methods of determination of orders are studied and understood.
CO2	At the end of this course on Liquid State , the learner shall be able to identify the liquid state from other states of matter and differentiate between the various properties of matter particularly surface tension, viscosity, refractive index and polarizability. He will also know the experimental methods of determination of these properties, its instrumentation, the theory behind it and also the practical applications of the various properties. The learner will be able to understand the concept of liquid Crystal - its different types, its properties and applications.
CO3	The students will understand the importance of comparative chemistry of main group elements by studying their metallic and non-metallic nature, oxidation states, electronegativity, anomalous behaviour of second period elements, allotropy, catenation and diagonal relationship.
CO4	They will also gain the knowledge of comparative chemistry of carbides, nitrides, oxides and hydrides of Group-I and Group-II elements along with some important

	compounds. They will study environmental aspects of compounds of carbon, nitrogen and sulphur.
CO5	Learners will be able to distinguish and draw different molecular projections and to interconvert them.
CO6	Learners would be able to identify and assign stereo descriptors using CIP rules.
CO7	Learners would understand the conformers of alkanes and their relative stabilities.
SEM-II	
PAPER 1	Course Title: Chemistry Paper I Course Code: USCH201
CO1	On completion of this topic on Gaseous State , the students will be able to recapitulate the basic concepts such as gas laws, kinetic theory of gases etc. They will learn about the deviation of real gases from ideal behaviour, compressibility factor, Van der waal equation, Joule- Thomson effect- qualitative discussion and experimentation, Inversion temperature.
CO2	On completion of this topic on Chemical Equilibria and Thermodynamic Parameters , the student will know about reversible and irreversible reactions, dynamic equilibria and equilibrium constant(K_p and K_c), the relation between
CO3	The learner will have holistic knowledge of the nature of compounds in chemistry and categorise them as Acid, Base or Neutral.
CO4	In chemistry of aliphatic hydrocarbons, the students will be able to learn the chemistry of C-C Sigma bonds and C-C pi bonds.
CO5	Preparation, chemical properties and reactions of alkanes, alkenes, alkynes.
PAPER 2	Course Title: Chemistry Paper II Course Code: USCH202
CO1	The main objective of teaching this course is to make students understand about the concept of equilibrium in chemical reactions, pH and p H of buffer solution, Molecular Spectroscopy and Solid State.
CO2	The students will study the concept of chemical bond and reactivity in which they understand the types of bonds along with comparison, polarizability, shapes of molecules, Lewis dot structure, VSEPR theory, isoelectronic principles, applications and limitations of VSEPR theory.
CO3	The students will understand the importance of oxidation reduction chemistry by understanding the concept of reduction potentials, redox potentials along with applications of redox chemistry.
CO4	Conformational analysis of cycloalkanes would be learnt.
CO5	Basics of aromatic compounds, Huckel's rule of aromaticity would be learnt. Learners would be able to write the mechanism of electrophilic aromatic substitution and understand Hammond's postulates.
S.Y.B.Sc	
SEM-III	
PAPER 1	Course Title: General Chemistry Course Code: USCH301

CO1	At the end of the course on Thermodynamics , the student will be able to- identify the unique vocabulary associated with thermodynamics, understand the concept of free energy, derive and apply the Helmholtz and van't Hoff's equations to different thermodynamic systems, learn concept of open system, partial molal properties, chemical potential, fugacity and activity, derive and apply Gibbs – Duhem equation
CO2	On completion of this course on Electrochemistry , the student should be able to-define basic terms related to electrolyte conductivity, predict how the conductivity of an electrolyte depends on the electrolyte concentration, learn what are industrial applications of conductivity measurements
CO3	The students will understand the fundamentals of Chemical Bondings , various types of chemical bonds and their nature; structures of various types of crystals by using ball-and-stick models. The students will also grasp the concepts of Molecular Orbital Theory to explain the orbital pictures and the energies of different types of molecules.
CO4	The students will be able to understand the general mechanism of nucleophilic substitution reactions.
CO5	The students will be able to explain the properties and reactivity of Alcohols and Phenols. The students will be able to understand the concept of Epoxides and their Ring opening reactions.
PAPER 2 Course Title: General Chemistry Course Code: USCH302	
CO1	On completion of this course Chemical Kinetics , the student should be able to recall and explain why certain factors such as concentration, temperature, medium and the presence of a catalyst will affect the speed of a chemical change, interpret a reaction coordinate diagram with respect to the concept transition states, an activation energy and reaction intermediates, derive, manipulate and properly employ the Arrhenius Equation.
CO2	On completion of this course Solutions , the students will construct P-x-y, T-x-y diagrams for ideal and non-ideal binary miscible liquid-liquid systems. The student will describe salient features of liquid-liquid phase equilibrium plots. The student will understand the basics of various distillation processes.
CO3	On completion of this course students will acquire the knowledge of electron deficient compound of p block element like boron
CO4	The learner will have knowledge of compounds of p block elements like compounds of silicon, Germanium and Nitrogen
CO5	The students will be able to understand the nomenclature of carbonyl compounds. The students will understand the mechanism of nucleophilic addition reactions of carbonyl compounds.
CO6	The students will be able to understand the mechanisms of some name reactions of carbonyl compounds.
PAPER 3 Course Title: Chemistry Paper III Course Code: USCH303	

CO1	In role of analytical chemistry ,the learner will have complete holistic knowledge about the subject of analytical chemistry which is a new subject to them
CO2	The topic significance of sampling in analytical chemistry depicts the techniques in sampling of solids .liquids and gases which will give the learner a good broad view about the preparative step of sampling required for analysis
CO3	By studying the topic of classical methods of analysis ,the learner will get a complete theoretical knowledge about the classical methods such as gravimetric and titrimetric analysis which are performed by the learner in practicals which is a added asset to them in their further career as a chemist
CO4	In the topic Instrumental method,the basic concepts of spectroscopy discussed ,thereby the learner will get a complete idea about the principle involved in spectroscopic analysis ,classification of analytical methods such as spectroscopic ,electroanalytical ,thermal methods will outline various methods clearly in the minds of the learner
CO5	The theory behind absorption and emission spectroscopy and the instrumentation of UV Visible spectrophotometer will be greatly beneficial to the learner to understand the working of the instrument and to operate the instrument in his future career.

SEM-IV

PAPER 1 Course Title: General Chemistry Course Code: USCH401	
CO1	On completion of this course on Electrochemistry , the student should be able to - evaluate fundamentals of electrochemistry, evaluate electrodes and cells, discuss electrode potentials and cell thermodynamics, explain the type of electrodes, explain the types of indicator electrodes, express the Nernst equation
CO2	On completion of this course on Phase Diagram , the student should be able to - explain the basic definitions and terms in a phase diagram,defines phase, equilibrium, component, degree of freedom and phase rule concepts, learn applications of phase rule to different systems
CO3	The students will understand the concepts of Co-ordination Compounds , ligands and their types, structures and geometries of coordination compounds, Werners theory of coordination compounds. The students will learn the fundamentals, concepts, nature, periodic properties, the properties of different compounds in the course Comparative Study of Transition (p-block) Elements .
CO4	The learner will be able to understand nomenclature, structure and properties of Carboxylic acids.
CO5	The learner will be able to understand the nomenclature of Sulfonic acids and mechanism of Sulfonation of Benzene.
PAPER 2 Course Title: General Chemistry Course Code: USCH402	
CO1	Upon completion of Solid State course, the students will be able to - define crystal, crystal lattice and unit cell, explains various crystal systems, crystal planes and directions, Miller and Weiss indices, Diffraction of waves by crystals and Bragg's law, determination of interplanar distance by XRD

CO2	Upon completion of Catalysis course, the students will be able to: understand different types of catalysts, their mode of action, advantages and disadvantages, as well as their principal applications, evaluate the activity, selectivity of the catalytic processes, know the main homogeneous reactions catalyzed by acids, bases and enzymes and their reaction mechanisms
CO3	Studying the environmental aspect of oxides and oxoacids of nitrogen, sulphur and phosphorus.
CO4	Accomplish knowledge of behaviours of different cations and anions in water.
CO5	The learner will be able to understand the nomenclature and basicity of Amines and electrophilic substitution reactions in Aromatic Amines.
CO6	The learner will be able to clarify structure, aromaticity, synthesis and reactivity of 5-and 6-membered Heterocyclic compounds.
PAPER 3 Course Title: Chemistry Paper III Course Code: USCH403	
CO1	The effect of studying methods of separation is that the learner will get well versed with the various analytical separation used as a preparative step for analysis in a small and large scale, the learner will understand the various types of separation methods based on solubility, gravity, volatility, electrical effects, their principles and industrial applications
CO2	Solvent extraction depicts to the large separation methods used in industries as well as small scale separation with principles
CO3	Chromatography topic will show how separation can be done on small quantities and also qualitative analysis can be done on the basis of R _f values. Their separation skill is also developed due to practicals of paper chromatography and thin layer chromatography which are included in the practical course
CO4	The instrumental methods based on electroanalytical techniques such as Potentiometry, conductometry and pH metry will help them to understand titrations without indicators using instruments done in an accurate manner
CO5	Statistical treatment of analytical data will give the learner a complete idea about the method used for quality control in industry and equip them with the criteria of accepting or rejecting data using various tests such as test significance, 2.5d, 4d Q test, F test etc
T.Y.B.Sc	
SEM-V	
PAPER 1 Course Title: Physical Chemistry Course Code: USCH501	
CO1	Upon completion of the course on Molecular Spectroscopy , the students will be able to: understand the basic physical chemistry that govern molecular spectroscopy, students will understand basic information about different molecular spectroscopy methods such as microwave (rotational), IR (vibrational) and Raman, students will be able to select molecular spectroscopy methods suitable for solving given scientific problem

CO2	In this course of Thermodynamics , the learner will learn about Colligative properties such as Vapour Pressure, Elevation in boiling point, Depression in freezing point and Osmotic pressure. He will also be able to derive their relationships with molar mass of non volatile solute and the methods of determination of these properties..
CO3	By studying the topic of Chemical Kinetics , the learner will get the knowledge of collision theory of reaction rates and its application to unimolecular and bimolecular reactions. They will also learn about the classification of slow, fast and ultra fast reactions and the study of fast reactions by Stop Flow method and Flash Photolysis method
CO4	After completing this course of Surface chemistry and Colloids the student will gain knowledge with respect to – the concept of occurrence of adsorption processes, will be able to generate adsorption isotherm models, their derivation and applications, describing and explaining different types of colloidal systems, describing interactions between colloidal particles and explaining colloidal stability and instability, describing structure and properties of self-associating colloidal systems.
CO5	From the study of Nuclear Chemistry, the learner will be able to understand the basic terms- radioactive constants and units of radioactivity, types of nuclear radiations , measurement of nuclear radiations, instrumentation and working of G.M. counter and scintillation counter. He will get knowledge of radioisotopes and their applications, nuclear reactions, Q-value and threshold energy of nuclear reactions,nuclear reactors and also fission and fusion processes
PAPER 2	Course Title: Inorganic Chemistry Course Code: USCH502
CO1	Acquiring the knowledge and understanding of symmetry of molecules for determination and description of structures of molecules in chemistry.
CO2	Understanding bonding in heteronuclear polyatomic molecules with the help of advance theory like Molecular Orbital Theory
CO3	Understanding degree of order and perfection in the structures of crystalline solids and forces and energies associated with them (solid state Chemistry)
CO4	The students will understand the importance of non-aqueous solvents with their classification and the concept of auto-ionization.
CO5	The students will get the knowledge of Group-16 elements with general trends, electronic configuration and allotrope
CO6	The students will know about Group-17 elements, their characteristics and the formation of interhalogens.
PAPER 3	Course Title: Organic Chemistry Course Code: USCH503

CO1	The learner should able to grasp the basic concept and terminologies involved in photochemical reactions with special emphasis on photochemical reactions of olefins and carbonyl compounds, importance of agrochemicals, classification based on structure and mode of action along with synthesis of certain agrochemicals. Advantage and disadvantage of agrochemicals with special emphasis on biopesticides.
CO2	linear and convergent synthesis, with special emphasis on chemo selective and regioselective reactions, multicomponent synthesis. Twelve principles of green chemistry with special emphasis on atom economy, e-factor, calculations and their significance. · characteristic features of terpenoids, alkaloids and hormones. Methods of isolation, structural elucidation in citral, nicotine and adrenaline.
CO3	Apply fundamentals of Organic Reaction Mechanisms to various reactions.
CO4	Complete understanding of Symmetry elements and chirality concept and the stereochemistry of chiral compounds without stereogenic compounds would be learnt.
CO5	Assign IUPAC names to bicyclo biphenyls, cumulenes, quinolines and isoquinolines. Also the basics of organic spectroscopy of UV-visible and mass spectrometry would be learnt.
PAPER 4 Course Title: Analytical Chemistry Course Code: USCH504	
CO1	The main objective of the course is to orient the students towards industry i.e. chemical industry. The student gained knowledge of Validation methods ,The aspects of quality control, sampling and chemical calculation. . By studying chemical calculations students learned about stoichiometry and methods of expressing concentration of solution. In the estimation of % of magnesium in a given talcum powder student will convert insoluble oxide of magnesium by using HCl into soluble salt form and practice complexometry.
CO2	The main objective of the course is Knowledge inclusion in students by conducting theory lectures on titrimetry analysis. By studying titrimetry analysis students learned different types of titrations, methods to determine equivalence point, selection of indicator and quantitative analysis. Learners will determine the amount of persulphate ions in the given solution by back titration with standard Ferrous ammonium sulphate solution and understand the redox reaction involved in the estimation.
CO3	The main goal of teaching optical methods is to incorporate knowledge and skill in students to make them capable of operating various instruments used for analysis such as UV Visible spectrophotometry. Flame photometer, Atomic absorption spectrophotometer, fluorometer ect. Learner determine the chemical oxygen demand of the given water sample by using potassium dichromate in acidic medium which oxidises organic substances present the given water sample.and back titration is understood.

CO4	The main goal of the teaching method of separation is Knowledge inclusion in students about solvent extraction, HPLC, HPTLC. the course provides information about the basic principle, instrumentation, working and its applications so as to enable students to work on advanced instruments in analytical laboratory.
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PAPER 5	Course Title: Applied Chemistry	Course Code: USCH505
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CO1	The students will be able to understand Dyes, Requirements of a good dye, Suffixes of Commercial Dyes with at least one example (Nomenclature of Dyes).
CO2	The learner will be able to understand the general idea of Optical Brighteners, their characteristics and their classes.
CO3	The learner will be able to understand Armstrong's theory, Witt's theory, VBT, MOT to explain the colour of compounds.
CO4	Students are supposed to learn the etiological concepts, chemical classes, chemical structures, uses and side effects of pharmacodynamic drugs like Analgesics, Antipyretics and Anti-inflammatory (SAID & NSAID) drugs, Antihistaminic drugs, CNS drugs, Antiparkinsonism drugs.
CO5	Students will inculcate the basic concepts involved in Cardiovascular drugs, Drugs for respiratory system, Anthelmintic and Antifungal drugs and chemical classes, structures, uses and side effects of these drugs.
CO6	Students will understand the fundamentals of a drug, characteristics of an ideal drug; classification, nomenclature of drugs and definitions of some terms like pharmacophore, pro-drug, half-life efficiency, LD ₅₀ , ED ₅₀ , Therapeutic index, receptors, drug-receptor interaction, bioavailability, drug potency; Various routes of drug administrations.

SEM-VI

PAPER 1	Course Title: Physical Chemistry	Course Code: USCH601
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CO1	At the end of this course on Electrochemistry students should- know the different types of galvanic cells in particular concentration cells, know the importance of electrochemical processes in today's world, know the principles of electrochemistry and its applications, able to apply Nernst equation and the Tafel equation to different electrochemical systems
CO2	At the end of the Polymer course students should- define polymer science related terms, summarize historical evolution and classification of the polymers, learn the concept of average molecular weight, its types, solving numerical problems, and learning different experimental methods to determine it.
CO3	By studying the course on Basics of Quantum Mechanics , the learner will understand the limitations of classical mechanics and how it is possible to explain the behaviour of subatomic particles with the application of quantum mechanics (black body radiation, photoelectric effect, Compton effect). He will learn about

	Schrodinger's wave equation, its interpretation and properties of wave function. He will also be able to learn about Operators, Eigen function and Eigen values
CO4	From the topic of Renewable Energy Resources , the learner will get to know about the conventional resources of energy and renewable (alternative) resources of energy. He will be able to get information about photoelectric effect, Solar cell- its working and advantages., semiconductors and insulators. The learner will also get knowledge of Hydrogen - the fuel of future
CO5	On the completion of the topic of NMR - Nuclear Magnetic Spectroscopy , the learner will understand the principle of NMR, nuclear spin, magnetic moment, nuclear g-factor, Larmour precession, Relaxation processes in NMR and instrumentation of NMR Spectrometer From the study of ESR- Electron Spin Resonance Spectroscopy, the learner will be able to understand its fundamental principle, electron g-factor, hyperfine splitting and experimental set up of ESR spectrometer. The learner will also be able to explain Hydrogen and Deuterium spectra.
PAPER 2 Course Title: Inorganic Chemistry Course Code: USCH602	
CO1	The students will understand the limitations of Valence bond theory. They will understand the importance of crystal field theory, effect of crystal field on central metals valence orbitals. The students will get the knowledge of how splitting of d-orbitals takes place in octahedral, square planar and tetrahedral crystal fields. The learner will be able to get the idea of distortions from octahedral geometry, crystal field splitting , spectrochemical series, crystal field stabilization energy with calculations etc., limitations of CFT.
CO2	The students will understand the importance of molecular orbital theory for co-ordination compounds. They will learn about molecular orbital diagrams. The students will get the knowledge of stability of metal complexes where they will study thermodynamic and kinetic stability, stepwise and overall stability constants. The students will know about reactivity of metal complexes along with types of reactions in metal complexes, inert and labile complexes, ligand substitution reactions. The students will understand the concept of electronic spectra where they will study types of electronic transitions in co-ordination compounds, selection rules for electronic transitions etc.
CO3	Acquiring knowledge about organometallic compound whose generally used as catalyst
CO4	Understanding how to obtain metals from their natural source for their industrial and commercial use. (metallurgy)
CO5	Accomplish knowledge of compounds of group 18 elements and their uses
PAPER 3 Course Title: Organic Chemistry Course Code: USCH603	
CO1	The student will be able to understand the basis of biopolymer, general structure, classification and characteristic features of amino acid, polypeptides and proteins. Methods of preparation of amino acids and polypeptide synthesis

CO2	General structure of carbohydrates, classification, structure of monosaccharides: Fischer projection (4-6 carbon monosaccharide) and Haworth formula, furanose and pyranose form of pentose and hexose sugar, stereoisomers of D-Glucose, Mutarotation, chain lengthening and chain shortening reactions along with special reactions of D-Glucose and D-Fructose
CO3	General introduction and various terms involved in polymers, different types of polymers such as condensation, addition based on synthesis. stereochemistry of polymer, natural and synthetic polymer, additives in polymer and biodegradable polymer, catalyst and reagent with respect to functional group transformation and selectivity
CO4	The learner would be able to write the stereochemistry of various reaction mechanisms. Also the mechanisms of the rearrangement reactions such as Pinacol-pinacolone rearrangement, Beckmann rearrangement, Favorski rearrangement, Michael addition, and Wittig reaction with examples and stereochemistry wherever applicable.
CO5	Learners would understand the basics of IR and PMR. Structure elucidation of various simple molecules on the basis of UV, mass, IR and PMR values would be learnt.
PAPER 4 Course Title: Analytical Chemistry Course Code: USCH604	
CO1	In the estimation of reducing sugar i.e. glucose in honey sample students will learn about redox reactions by using Winstanley's method
CO2	In the estimation of zinc and magnesium by using anion exchange resin student will learn about the basic principles of the ion exchange method.
PAPER 5 Course Title: Applied Chemistry Course Code: USCH605	
CO1	The learner will be able to understand the types of dyes such as Nitro, Nitroso, Azo dyes, Heterocyclic dyes, Quinone dyes etc.
CO2	The students will be able to understand non-textile uses of dyes such as Biomedical uses, dyes used in food and cosmetics, dyes used for Paper and Leather, use of dyes as indicators, hair dye etc.
CO3	The learner will be able to understand the concept of Make in India-Future Prospects of Dye Industry.
CO4	The students will inculcate the knowledge about chemical classes, structures, uses and side effects and syntheses of various chemotherapeutic drugs like Anticancer drugs, Anti-HIV drugs, Antimalarial drugs, Antineoplastic drugs, Antituberculosis and Antileprotic drugs.
CO5	The students will also learn the advanced trends in Drug discovery, design and development; concepts in the drug metabolism like Absorption, Metabolism of drugs, Excretion of metabolites after metabolism with examples.
CO6	The students shall also understand concepts, structures of Drug Intermediates and their uses in the manufacture of a number of drugs.