

## DEPARTMENT OF CHEMISTRY

### PROGRAMME OUTCOME, PROGRAM SPECIFIC OUTCOME:

Name of the Programme	Programme Outcome	Program Specific Outcome
<p style="text-align: center;"><b>UG (B.Sc.): BACHELOR OF SCIENCE</b></p>	<ul style="list-style-type: none"><li>• Demonstrate, solve and an understanding of major concepts in all disciplines of chemistry.</li><li>• Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions.</li><li>• Create an awareness of the impact of chemistry on the environment, society, and development outside the scientific community.</li><li>• Find out the green route for chemical reaction for sustainable development.</li><li>• Use modern techniques, decent equipment and Chemistry software's</li><li>• To inculcate the scientific temperament in the students and outside the scientific community.</li><li>• Solve the problem and also think methodically, independently and draw a logical conclusion</li></ul>	<p>To explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions.</p> <ul style="list-style-type: none"><li>• Identify chemical formulae and solve numerical problems.</li><li>• To make the learner capable of acquiring or pursuing a source of livelihood like jobs in chemical industry.</li><li>• Use modern chemical tools, Models, Chem-draw, Charts and Equipments</li><li>• Gain the knowledge of Chemistry through theory and practical's.</li><li>• Understand good laboratory practices and safety.</li><li>• Develop research oriented skills. Know structure-activity relationship.</li><li>• Make aware and handle the sophisticated instruments/ equipment.</li></ul>

**COURSE OUTCOMES OF ALL COURSES OFFERED BY THE DEPARTMENT:**

Name of the Course : B.Sc.

CLASS	SEM	PAPER NO	PAPER CODE	PAPER	LEARNING OUTCOMES
F.Y.B.Sc.	I	I	USCH101	Physical, Organic, Inorganic	At the end of this course students should be able to: <ul style="list-style-type: none"><li>• Understand basic thermodynamics terms with basic knowledge of zeroth and first law of thermodynamics.</li><li>• Acquire knowledge of different types of concentrations of solutions and calculations for preparing the solution.</li><li>• Understanding the basic concept of structure of an atom with relevant terminologies.</li><li>• Recapitulation of certain concepts.</li><li>• Exploring the periodic table and its various periodic properties.</li><li>• Learn IUPAC nomenclature &amp; basic of organic molecules, structure, bonding, and reactivity reaction mechanisms.</li><li>• Concept of hybridization and geometry of atoms, Electrophile, nucleophiles, free radicals, electronegativity, resonance, and intermediates along the reaction pathways.</li></ul>
F.Y.B.Sc.	I	II	USCH102	Physical, Organic, Inorganic	At the end of this course students should be able to: <ul style="list-style-type: none"><li>• To inculcate knowledge about rate of reactions and order of reactions study different methods to determine order of reactions.</li><li>• Acquire knowledge of different structures of liquid crystals</li><li>• Compare the general properties of main group elements and inculcate the knowledge in application in periodic table.</li><li>• Compare the properties and understand the concept of carbides, nitrides, oxides and hydrides.</li><li>• Exposure to environmental problems and solution to its adverse effects.</li><li>• Identify 3-D structure of organic molecules &amp; chiral centers.</li></ul>

					<ul style="list-style-type: none"> <li>• Able to understand Stereochemistry of organic molecules. Conformation and configuration, asymmetric molecules and nomenclature.</li> </ul>
F.Y.B.Sc.	I	I and II	USCHP1	Practical	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Do the purification of organic compounds by crystallization using the solvents</li> <li>• Develop command on pipette handling</li> <li>• Prepare standard solutions</li> </ul>
					<p>At the end of the practical,</p> <ul style="list-style-type: none"> <li>• Student will develop the skill of handling apparatus and use of chemicals.</li> <li>• Skill of standardization.</li> <li>• Determine the melting points of given organic compounds and unknown organic compounds.</li> <li>• Purification techniques for organic compounds</li> </ul>
F.Y.B.Sc.	II	I	USCH201	Physical, Organic, Inorganic	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Understand kinetic theory of gaseous</li> <li>• Students acquire knowledge about Maxwell - Boltzmann distribution theory.</li> <li>• To develop fundamental knowledge of chemical equilibrium and thermodynamics parameter</li> <li>• Gain knowledge about reversible and irreversible reactions, Le -Chaterliar principle.</li> <li>• Acquiring the basics of qualitative analysis and developing an understanding on different terms in qualitative analysis.</li> <li>• Problem solving skill development on various numericals.</li> <li>• Comparing the differences between acids and bases on the basis of various theories.</li> <li>• Learn preparation &amp; reactions of alkanes, alkenes &amp; alkynes.</li> </ul>

F.Y.B.Sc.	II	II	USCH202	Physical, Organic, Inorganic	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Have knowledge of various types of electrolytes and factors affecting to it. Students are able to understand concept of buffer solution.</li> <li>• Learn the concept of laws of crystallography</li> <li>• Understand the general types of bonds.</li> <li>• Learn concepts of VSEPR theory and its application in various molecules.</li> <li>• Recapitulation and learning of oxidation and reduction reactions.</li> <li>• Explain various conformations and conformational analysis of cyclohexane.</li> </ul>
F.Y.B.Sc.	II	I and II	USCHP2	Practical	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Learn good laboratory practices and its applications</li> <li>• Understand the use of personal protective and other safety equipment's, handling of chemicals in laboratory</li> </ul>
					<p>At the end of the practical, student will be able to</p> <ul style="list-style-type: none"> <li>• Identify the cations and anions by qualitative analysis through basic chemical tests.</li> <li>• Learn characterization of single organic compounds.</li> </ul>
S.Y.B.Sc.	III	I	USCH301	Physical, Organic, Inorganic	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Gain knowledge of concept of free energy Functions</li> <li>• Understand the concept of Fugacity and activity</li> <li>• Acquire knowledge of determination of quantum efficiency by Actinometer.</li> <li>• Assimilate concept of thermal chain reactions</li> <li>• Develop knowledge about conductivity concept, Understand Kohlrausch Law and its application in various fields.</li> <li>• Gain knowledge of Arrhenius theory of electrolyte dissociation</li> </ul>

				<ul style="list-style-type: none"> <li>• Students came across the new concept Debye -Huckel's theory, electrophoresis and relaxation effect.</li> <li>• Assimilate about Complexometric titration, metallochromic indicators.</li> <li>• Acquire knowledge of types of separation techniques.</li> <li>• Understand concept solvent extraction thoroughly</li> </ul> <p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Understanding the concept of Valence Bond Theory and Molecular Orbital Theory.</li> <li>• Learning the formation of ionic bond.</li> <li>• Comparing properties of transition metals.</li> <li>• To understand organic chemistry reactions and reaction mechanisms of alkyl arenes, haloarenes, phenols &amp; aromatic nitro compounds.</li> <li>• To learn preparation &amp; reactions of alkanes, alkenes &amp; alkynes.</li> <li>• To Recognize IUPAC nomenclature and aromaticity of aromatic compounds.</li> <li>• To understand various mechanisms of aromatic reactions.</li> </ul>
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S.Y.B.Sc.	III	II	USCH302	Physical, Organic, Inorganic	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Gain knowledge of concept of free energy Functions</li> <li>• Understand the concept of Fugacity and activity</li> <li>• Acquire knowledge of determination of quantum efficiency by Actinometer.</li> <li>• Assimilate concept of thermal chain reactions</li> <li>• Develop knowledge about conductivity concept, Understand Kohlrausch Law and its application in various fields.</li> <li>• Gain knowledge of Arrhenius theory of electrolyte dissociation</li> <li>• Students came across the new concept Debye -Huckel's theory, electrophoresis and relaxation effect.</li> <li>• Assimilate about Complexometric titration, metallochromic indicators. •</li> <li>• Acquire knowledge of types of separation techniques.</li> <li>• Understand concept solvent extraction thorouly</li> </ul> <p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Understanding the concept of Valence Bond Theory and Molecular Orbital Theory.</li> <li>• Learning the formation of ionic bond.</li> <li>• Comparing properties of transition metals.</li> <li>• To understand organic chemistry reactions and reaction mechanisms of alkyl arenes, haloarenes, phenols &amp; aromatic nitro compounds.</li> <li>• To learn preparation &amp; reactions of alkanes, alkenes &amp; alkynes.</li> <li>• To Recognize IUPAC nomenclature and aromaticity of aromatic compounds.</li> <li>• To understand various mechanisms of aromatic reactions.</li> </ul>
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S.Y.B.Sc.	III	III	USCH303	Analytical	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Use statistical methods in chemical analysis.</li> <li>• Learn different calculations used in different interpretation of data obtained from instrument.</li> <li>• To learn different techniques of sampling of solid, liquid , and gases</li> <li>• More emphasis on the detail study of TLC, HPLC, HPTLC and PC with their application</li> <li>• Learn principle of instrumentation, application of FES, AAS, Fluorescence phosphorescence spectroscopy, Turbidimetry, and Nephelometer.</li> <li>• Assimilate basic terms involved in solvent extraction and factors affecting solvent extraction</li> <li>• Comparative study of solid phase extraction and solvent extraction</li> </ul>
S.Y.B.Sc.	III	I,II,III	USCHP1, USCHP2, USCHP3	Practical	<p>At the end student will learn to master in qualitative &amp; quantitative analysis of inorganic compounds</p> <ul style="list-style-type: none"> <li>• To study organic compounds analysis</li> <li>• To learn the concept of water analysis like hardness, pH, conductivity</li> <li>• To learn the use of Conductometer, chemical kinetics concepts in daily life.</li> </ul> <p>At the end of this practical course, students will acquire the basic training of handling the apparatus and learn to identify the inorganic compound through qualitative and quantitative analysis.</p> <p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Do organic estimation and organic reactions of various organic compounds.</li> </ul>
S.Y.B.Sc.	IV	I	USCH401	Physical, Organic, Inorganic	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Gain the knowledge of transport number and its determination by Moving boundary method.</li> </ul>

					<ul style="list-style-type: none"> <li>• Understand the concept of Liquid Crystals, phases of liquid crystals, application of Liquid Crystals</li> <li>• Distinguish between different types of liquid mixtures.</li> <li>• Assimilate thorough concept of Beer Lambert's Law</li> <li>• Know different instrumentation of single beam and double beam photoelectric colorimeter, photometric titration.</li> <li>• Able to measure central tendency and dispersion <ul style="list-style-type: none"> <li>• Study of performance characteristics of Analytical method</li> </ul> </li> </ul> <p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Introduction and understanding about the new concept of coordination chemistry.</li> <li>• Pursuing the knowledge of bioinorganic chemistry where the learning will be interlinked between biological and inorganic chemistry concepts. • Gaining the knowledge of organometallic compounds. <ul style="list-style-type: none"> <li>• Identify and name different IUPAC nomenclature, organic reactions and reaction mechanisms of Aldehyde, Ketones, and Carboxylic acid &amp; Amino compounds.</li> </ul> </li> <li>• Understand the reactions and mechanisms of diazonium compounds.</li> <li>• Acquire knowledge of Stereochemistry of organic molecules – R/S nomenclature, Resolution of stereoisomers.</li> </ul>
S.Y.B.Sc.	IV	II	USCH402	Physical, Organic, Inorganic	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Gain the knowledge of transport number and its determination by Moving boundary method.</li> <li>• Understand the concept of Liquid Crystals, phases of liquid crystals, application of Liquid Crystals</li> <li>• Distinguish between different types of liquid mixtures.</li> <li>• Assimilate thorough concept of Beer Lambert's Law</li> </ul>



					<ul style="list-style-type: none"> <li>• Know different instrumentation of single beam and double beam photoelectric colorimeter, photometric titration.</li> <li>• Able to measure central tendency and dispersion <ul style="list-style-type: none"> <li>• Study of performance characteristics of Analytical method</li> </ul> </li> </ul> <p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Introduction and understanding about the new concept of coordination chemistry.</li> <li>• Pursuing the knowledge of bioinorganic chemistry where the learning will be interlinked between biological and inorganic chemistry concepts.</li> <li>• Gaining the knowledge of organometallic compounds. <ul style="list-style-type: none"> <li>• Identify and name different IUPAC nomenclature, organic reactions and reaction mechanisms of Aldehyde, Ketones, and Carboxylic acid &amp; Amino compounds.</li> </ul> </li> <li>• Understand the reactions and mechanisms of diazonium compounds.</li> <li>• Acquire knowledge of Stereochemistry of organic molecules – R/S nomenclature, Resolution of stereoisomers.</li> </ul>
S.Y.B.Sc.	IV	III	USCH403	Analytical	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Use statistical methods in chemical analysis.</li> <li>• Learn different calculations used in different interpretation of data obtained from instrument.</li> <li>• To learn different techniques of sampling of solid, liquid, and gases</li> <li>• More emphasis on the detail study of TLC, HPLC, HPTLC and PC with their application</li> <li>• Learn principle of instrumentation, application of FES, AAS, Fluorescence phosphorescence spectroscopy, Turbidimetry, and Nephelometer.</li> <li>• Assimilate basic terms involved in solvent extraction and factors affecting solvent extraction</li> </ul>

					<ul style="list-style-type: none"> <li>• Comparative study of solid phase extraction and solvent extraction</li> </ul>
S.Y.B.Sc.	IV	I,II,III	USCHP4, USCHP5, USCHP6	Practical	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Develop skill in handling instruments like pH meter, Conductometer</li> <li>• Apply knowledge of redox titration.</li> <li>• Able to find out molar absorptivity by photometrically</li> <li>• Learn good laboratory practices.</li> </ul> <p>At the end of this practical course</p> <ul style="list-style-type: none"> <li>• Students will develop the skill of using particular reagents used during practical process and understand the necessary conditions to be maintained during preparation of inorganic complexes.</li> <li>• Connecting the theoretical knowledge to practical work.</li> </ul> <p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Characterize single organic compounds.</li> <li>• To learn how to use pH meter, spectrophotometer</li> <li>• To study the concept of gravimetric analysis in the determination of particular ion like Ni</li> <li>• To study the concept of formation of complexes</li> </ul>
T.Y.B.Sc	V	I	USCH501	Physical Chemistry	<p>At the end of this course, students will be able,</p> <ul style="list-style-type: none"> <li>• To explain various colligative properties of solution and to determine the molecular weight using the properties.</li> <li>• To know the meaning of phase, component and degree of freedom and phase rule.</li> <li>• To study concept of surface adsorption and to study the B.E.T equation for multilayer adsorption.</li> <li>• To understand the electrical properties of Colloids.</li> <li>• To learn the basic concepts involved in electrochemistry. • To learn the basic terminologies involved in polymer chemistry.</li> </ul>

T.Y.B.Sc.	V	II	USCH502	Inorganic Chemistry	<p>At the end of this course, students will be able to:</p> <ul style="list-style-type: none"> <li>• Acquire knowledge on importance of Molecular symmetry and relate to the symmetry around nature.</li> <li>• Understand the basics of structure of solids and superconductivity.</li> <li>• Acquire the knowledge on different inner transition elements with their individual separation process.</li> <li>• Gathering the concept of Non -aqueous solvents and its importance</li> </ul>
T.Y.B.Sc.	V	III	USCH503	Organic Chemistry	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Write mechanism of elimination reaction, reaction of carbonyl compound with nucleophile and rearrangement reactions.</li> <li>• Acquire knowledge of Stereochemistry of organic molecules – Element of symmetry, conformations of cyclohexane, stereo selective &amp; stereospecific reactions, stereochemistry of substitution and addition reaction.</li> <li>• Able to aware with various terms related with carbohydrates.</li> <li>• Write IUPAC nomenclature of bicycle compounds.</li> <li>• Understand heterocyclic compounds and their reactions.</li> </ul>
T.Y.B.Sc.	V	IV	USCH504	Analytical Chemistry	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Use statistical methods in chemical analysis.</li> <li>• Learn different calculations used in different interpretation of data obtained from instrument.</li> <li>• To learn different techniques of sampling of solid, liquid , and gases</li> <li>• More emphasis on the detail study of TLC, HPLC, HPTLC and PC with their application</li> <li>• Learn principle of instrumentation, application of FES, AAS, Fluorescence phosphorescence spectroscopy, Turbidimetry, and Nephelometer.</li> </ul>

					<ul style="list-style-type: none"> <li>• Assimilate basic terms involved in solvent extraction and factors affecting solvent extraction</li> <li>• Comparative study of solid phase extraction and solvent extraction</li> </ul>
T.Y.B.Sc.	V	I	USCHP01	Physical Chemistry Practical	<p>To enable the student to use techniques such as potentiometer and colorimeter for studying redox reaction and acid base titration.</p> <ul style="list-style-type: none"> <li>• How to test the validity of Freundlich adsorption isomer.</li> <li>• To study the empirical formula of complex</li> </ul>
T.Y.B.Sc.	V	II	USCHP05	Inorganic Chemistry Practical	<ul style="list-style-type: none"> <li>• At the end of this practical course, students will learn to prepare inorganic complexes with understanding of structure and role of metal and ligands.</li> <li>• Skill based learning of qualitative preparation.</li> </ul>
T.Y.B.Sc.	V	III	USCHP09	Organic Chemistry Practical	<p>Do Separation of a mixture of two solid organic compounds by using chemical method.</p> <ul style="list-style-type: none"> <li>• Able to synthesis various organic compounds in laboratory.</li> </ul>
T.Y.B.Sc.	V	IV	USCHP13	Analytical Chemistry Practical	<p>To study redox titration by determination Fe in tablet</p> <ul style="list-style-type: none"> <li>• Determination of Vitamin C by redox titration</li> <li>• To understand the concept of direct and blank titration in estimation of persulphate.</li> <li>• To become master in handling of the instruments like Colorimeter, spectrophotometer, Turbidimeter</li> <li>• To apply the concept of Calibration curve method studied in Theory during use of above instruments.</li> </ul>
T.Y.B.Sc.	VI	I	USCH601	Physical Chemistry	<p>At the end of this course, students will be able to</p> <ul style="list-style-type: none"> <li>• At the end of this course, students will be to learn the basic terminologies involved in electrochemistry.</li> <li>• Able to have a firm foundation in the fundamental and molecular spectroscopy.</li> <li>• To study the concepts classical mechanics and its limitations.</li> </ul>

					<ul style="list-style-type: none"> <li>• To understand polarization process and its elimination and concepts like decomposition potential and overvoltage.</li> <li>• To study the principle, instrumentation, working and application of NMR.</li> </ul>
T.Y.B.Sc.	VI	II	USCH602	Inorganic Chemistry	<p>At the end of this course, students will be able to learn Molecular Orbital Theory for coordination compounds and will practice by drawing MOT diagrams.</p> <ul style="list-style-type: none"> <li>• Assimilating knowledge on different aspects in Organometallic compounds.</li> <li>• Understanding of polymers which will expose to further studies.</li> <li>• Awareness of liquid effluents which will help in studying the waste treatment in larger scale.</li> <li>• Pharmaceutical studies of inorganic compounds.</li> </ul>
T.Y.B.Sc.	VI	III	USCH603	Organic Chemistry	<ul style="list-style-type: none"> <li>• At the end of this course students should be able to:</li> <li>• Use of reagents in various organic transformation reactions.</li> <li>• Understand concepts in Organometallic compounds and their uses.</li> <li>• Identify Structure of compounds through IR, NMR and Mass spectroscopic data.</li> <li>• Absorb knowledge of various basics concepts of polymers, photochemistry and natural products.</li> </ul>
T.Y.B.Sc.	VI	IV	USCH604	Analytical Chemistry	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• To understand the potentiometric titration and to learn the different types of potentiometric titration curve</li> <li>• Introduction of electroanalytical technique with reference to polarography and Amperometric titration.</li> <li>• To get the knowledge of basic terms, principle and application of polarography and amperometry.</li> <li>• To learn about the food industry with respect to food preservation and processing techniques</li> <li>• Study and analysis of food products and adulterant in milk , honey , tea, coffee</li> <li>• To acquire the principle , instrumentation and application of GSC and GLC</li> </ul>

					<ul style="list-style-type: none"> <li>• To study principle, mechanism and factors affecting Ion exchange chromatography, size exclusion chromatography with application with respect industry and biology</li> <li>• To know what is method of validation and various methods used for validation.</li> <li>• To understand the classification of electroanalytical method and emphasis on detail study of NAA with advantages , disadvantages and application</li> </ul>
T.Y.B.Sc.	VI	I	USCHP02	Physical Chemistry Practical	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• To learn how to determine the energy of activation by chemical kinetics experiment.</li> <li>• To learn how to determine equilibrium constant by partition coefficient method.</li> <li>• To enable the student to use techniques such as potentiometer, Conductometer for studying redox, acid base titration and Complexometric titration.</li> </ul>
T.Y.B.Sc.	VI	II	USCHP06	Inorganic Chemistry Practical	<p>At the end of this practical course, students will learn the technique of standardization.</p> <ul style="list-style-type: none"> <li>• Skill of preparation through step -wise systematic methodology.</li> <li>• Linking with the theoretical concept of iodometric and Complexometric with practical performance.</li> </ul>
T.Y.B.Sc.	VI	III	USCHP10	Organic Chemistry Practical	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• Do Separation of a mixture of two solid/liquid organic compounds by using physical method.</li> <li>• Able to prepare various organic compounds</li> </ul>
T.Y.B.Sc.	VI	IV	USCHP14	Analytical Chemistry Practical	<p>At the end of this course students should be able to:</p> <ul style="list-style-type: none"> <li>• To become master in the use and Standardization of pH meter, potentiometer.</li> <li>• Understanding of principle and application of these instrument in the analysis of vinegar sample and cola sample ,which student have learned in their second year of degree</li> </ul>

				<ul style="list-style-type: none"><li>• To understand the concept of reducing sugar in the determination these sugar in honey</li><li>• To learn Complexometric study in the analysis of talcum powder i.e determination of Ca in presence of Mg</li><li>• How to do Standardization of secondary standard like sodium hydroxide.</li></ul>
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