Department of Chemistry

Programme Outcome: The expected outcome of the course is to provide students with the concepts, principles, theories and practical applications of chemistry which facilitate them in pursuing their higher studies in chemistry, to boost their career and to apply Chemistry in their everyday life. The programme encourages the students towards logical thinking, finding solutions to different issues scientifically, finding the way to minimize pollutions, thinking about sustainable developement and also to make correct decisions when encountered with different challenges in life.

Course Code	Course Name	Course Outcomes
CEMH: H1	GENERAL	This course will provide interest to understand about the basic concepts of atomic model, nucleus, quantum numbers, various principles, electronic configuration, wave function, periodic table, periodic properties. The students will be aware of the importance of the elements of the periodic table and how to analyst and separate various elements through qualitative estimation.
	INORGANIC	To develop interest and understanding about the basic concepts of chemical bonding, hybridization, structure, H-bonding, metallic bond, lattice energy, Born-Haber cycle, factors affecting covalency, MOT, weak interactive forces, concept of oxidation, reduction, reduction potential, redox potential on the prospective of qualitative and quantitative analysis, redox indictor and titration.
	ORGANIC	From this course the students will be able to learn about the hybridisation of orbitals, the concepts of acids and bases dipole moment, types of reagents and intermediates, activation energy and Transition state, energy profile diagrams for reactions with single or multiple steps, reactions of alkyl/aryl halides-nucleophilic substitution and elimination reactions, structure and bonding including chemical reactivities of alcohols, phenols, aldehydes and ketones, reactions with mechanism.
	PHYSICAL	From this course the students will have knowledge about theories and laws of real gases, liquid state, the various crystalline structures and their defects, fundamental ideas about computer development, hardware, binary system, basic program. They will also be able to apply the knowledge acquired to solve problem relating to those topics.
CEMH: Paper-H2(A)	INORGANIC	The students can apply their knowledge and understanding about modern concepts of acid-base, SHAB principle, pH, effect of solvent on relative strengths of acids and bases – leveling effect, relative strengths of acids and bases (pKa and pKb concept). They are able to learn about the physical, chemical properties, solvation and complex formation tendencies of alkali and alkaline earth metals. Chemistry of lithium and beryllium their anomalous behavior and diagonal relationship. Students can acquire knowledge about noble gases especially xenon oxides, fluorides, oxyfluorides. Students will also learn about the periodic properties of p-block elements, inert pair effect and catenation, structure and bonding in diborane, some other important cpompounds of p-block elements. This course also gives idea about the preparation, structure and uses of compounds of elements belonging to s and p block elements.
	ORGANIC	From this course the students will be able to learn about configurational, conformational isomerism-Fischer, Newman and sawhorse projections, enantiomers, diastereomers, geometrical, pi-diastereomers and their nomenclatures, difference in chemical and physical properties of pi-diastereomers, optical isomers, chirality, asymmetry, dissymmetry, R/S and D/L notations of optical isomers, raceimic mixture and resolution. Students will also gather knowledge about conformational nomenclature, eclipsed , staggered , gauche and anti; dihedral angle, energy barrier of rotation, relative stability of conformers on the basis of steric effects, conformational analysis of

		ethane, n-butane, cyclohexane and monosubstitutedcyclohexanes; stability of cycloalkanes-strains in rings, angle strain and torsional strain , Baeyer strain theory and its limitations, asymmetric synthesis: stereospecific and stereoselective synthesis, regioselectivie synthesis, application of cram's rule, prelog's rule and Ahn-Felken rule. This chapter also include aromaticity, non aromatic, antiaromatic, homoaromatic (benzenoid and nonbenzenoid) and preparation & properties of benzene, naphthalene, anthracene and some reaction mechanism in aromatic compounds.
CEMH: Paper-H2(B)	INORGANIC (Practical)	This paper will impart skills and knowledge in identification basic and acid radicals through preliminary test such as nature, colour and solubility of compound: Dry Test and Wet test for Acid, Basic and interfering radicals, removal of interfering radical, group separation and group analysis. The students will develop skills and learning about salt analysis and can apply their knowledge in identification of radicals/compounds present in water, food etc.
	INORGANIC	From this course the students will learn about the IUPAC nomenclature of coordination compounds, isomerism, chelates, innermetallic compounds, VBT, CFT, CFSE, LFT, bonding and structures in coordinate compounds, origin of colour and magnetism in coordination compounds, selection rules for electronic transition and Curie law, Curie-Weiss law. Students can apply their basic knowledge gathered about properties, structures, colour and magnetic properties of coordination compounds in higher studies.
	PHYSICAL	From this course the students will learn about the various thermodynamic terms and thermodynamic functions and parameters, Carnot's cycle and Carnot's theorem, laws of thermodynamics, concept of heat and work, enthalpies of various reactions, osmosis and reverse osmosis with applications, law governing dilute solutions and colligative properties with derivations of important equations involved. They will gain knowledge about homogeneous and heterogeneous equilibrium and principle involved. They will be able to determine rates of various chemical reactions both theoretically and experimentally and also observe the effect of catalyst and determine energies of activation of such reactions. From knowledge and understanding of the above topics, they can perform calculations and apply to experiments.
CEMH: Paper-H3(B)	ORGANIC (Practical)	Systematic qualitative analysis of organic compounds for the detection of elements with two functional groups, determination of melting point of the compound, identification of the compound and preparation of derivative and determination of its melting point and purity of the compound by calculation of R_f factor. The students will develop skills and learning about organic compound analysis and can apply their knowledge in identification of compounds present in food, sample etc.
CEMH: Paper-H4(A)	ORGANIC	From this course the student will learn about carbocations, carbanions, carbenes (electrophilic and nucleophilic), arynes and nitrenes – synthesis, stability, structure and reactivity, synthesis and synthetic applications of diethyl malonate and ethyl acetoacetate, synthetic application of Grignard reagent, organo lithium and organo copper compounds. Reaction mechanism of rearrangement reactions like Pinacol-pinacolone, Dienone-phenol, Wagner-Meerwein, Beckmann, Wolff, Hoffmann, Curtius, Lossen, Schmidt, benzil-benzilic acid, Favorskii, Fries and Claisen, Demjenov. This will grow the thinking ability to design a route for molecule synthesis.

		From this course the student will learn about the laws in electrochemistry and electrical properties like solubility product and common ion effect and conductances etc. and apply them in experiments. They learn about strong acids and bases and weak acid and bases and derivation of hydrolysis constant for their salts, electrochemical cells, , types of electrodes and to determine their EMF. Students are able to examine different types of phase diagrams of one component and two component systems and types of liquid liquid-liquid mixtures, fractional crystallization, Thermal analysis, cooling curves, eutectic points, and different alloys.
CEMH: Paper-H4(B)		
	PRACTICAL (Physical)	Students will learn how to determine the surface tension of a given liquid / solution with a stalagmometer by drop weight method, the viscosity coefficient of a given liquid / solution by Ostwald's viscometer, the distribution coefficient of iodine between water and an organic solvent, the distribution coefficient of an organic acid between water and an organic solvent, the pH of a buffer solution by colour matching of indicator. Students will learn how to perform acid base titrations using a conductometer and potentiometer. This work develops the skill of the students to handle equipments as well as determination of different physical parameters.
CEMH: Paper-H5	INORGANIC	This paper is an advance studies on theories and applications such as error analysis, nuclear chemistry, stability of nucleus, nuclear fission, fusion reactions, radio carbon dating, chemistry of d-block elements, lanthanides and actinides, organometallic compounds, reactions, properties, nomenclature, EAN, Bioinorganic chemistry, active and passive transportation, Na-ion pump, hemoglobin, myoglobin, chlorophyll, anti cancer drug, chelation therapy, beneficial elements, poisoning effect of metals, antidotes. The students gain information about the various biological effects and properties of organometallic compounds. Therefore, they can apply their knowledge in predicting and elucidating of chemical effects on humam. They can also apply their knowledge on accuracy, precession and error of readings. The students will gather knowledge and understanding about the importance of elements in the biological system as well as their toxic effects.
	ORGANIC	From this course the student will learn about the classification, nomenclature, synthesis and reactions of monosaccharides, amino acids, urea, drugs, heterocyclic compounds. The students will learn about reactions and structure of disaccharides, classifications, isolation, structural elucidation, synthesis of terpenoids and alkaloids, proteins vitamins and their biological importance. The enzymes coenzymes, photochemical reactions, pericylic reactions and use of mass, UV-visible, IR and NMR spectra for structural elucidation.
CEMH: Paper-H6	PRACTICAL (Inorganic)	This paper will impart skills and knowledge in separation technique of radicals from a mixture and quantitatively estimate the amount of each radical present in it. The students can apply their knowledge in estimation of radicals in mixture by gravimetric as well as volumetric titration. Students gain knowledge about importance of equivalent weight, method of preparation of normal and molar solutions, redox titration, iodometric titration and pH dependant complexometric titrations. They learn how to prepare coordination compounds maintaining a particular molar ratio and reaction conditions.
	PRACTICAL (Organic)	This paper will impart skills and knowledge in quantitative estimation of organic compounds. The students can apply their knowledge in estimation of different organic compounds in their real life by volumetric titration. They learn how to synthesize organic compounds maintaining standard method.

CEMH: Paper-H7	GREEN	The students will be enlightened about the consequences and impact on environment, chemical applications and industrial development through green chemistry learning. Students will learn about the principles of green chemistry, atom economy, and environmental factor. This chapter also gives idea about green synthesis of some organic and inorganic compounds. Green chemistry also deal with sonochemical reaction, use of green reagents, green oxidizing agents, green catalysts, and green solvents. Students will get idea about sustainability development.
	INDUSTRIAL	This unit will impart skills and knowledge in purification of water, composition and manufacture of fertilizer, glass, cement, paints, soap, detergents, rubber, plastic, resins, silicones, cellulose in a large scale. The manufacture process of steel, stainless steel. Students will get idea about galvanization, rusting and corrosion. They will learn how to isolate different chemicals from coal, about Cracking of petroleum, knocking and octane number, biodiesel, synthetic petrol, LPG and CNG. This course also gives idea about the fermentation reaction of starch and sugar to produce alcohol.
	PHYSICAL	From this course the student will learn about limitation of classical thermodynamics, concept of distribution of energy; thermodynamic probability and entropy; Boltzmann distribution law, partition function and its significance, translational partition function of ideal monoatomic gas, Maxwell-Boltzmann statistics, Bose-Einstein Statictics and Fermi Dirac statistics, Thermodynamic functions in terms of partition functions, SackurTetrode equation, heat capacity of solids, Quantum Mechanics. Introduction to molecular spectroscopy and spectrometers. Born-Oppenheimer approximation and degrees of freedom. Rotational and vibrational spectra of diatomic molecules with derivations and applications. Isotope effect. Beer-Lambert's Law, Einstein Law, Concept of potential Energy curves, Frank condon Principle, Jablonski diagram, Florescence and phosphorescence photochemical and photosensitized reactions and quantum yield. Boltzmann distribution for degenerate and non degenerate cases, idea of partition function. Activity, ionic activity, mean ionic activity electrophoretic and relaxation effects. preparation and purification of colloids, properties of colloids – physical, mechanical (Brownian motion), optical (Tyndal effect), electrical (Zeta potential) properties, stability and protective action of colloids – Gold number; Hurdy – Schulze rule, coagulation, peptisation, salting out, mechanism of functioning of soap and detergents, micelle formation; critical micelles concentration (CMC), emulsions, application of colloids – determination of Avagadro's number from Perrin distribution equation and Einstein diffusion equation, introduction of nano particles & applications. This chapter also includes concentration cells with and without transport liquid junction potentials, EMF and its measurement, calculation of thermodynamic parameters from EMF. Applications of electrodes and potentiometric titrations with examples. Students will also learn about Freundlich, Langmuir and Gibb's adsorption isotherms – their derivations, BET equation, determination of surface area of adsorbates, application adsorption phenomenon in nature and industry
CEMH: Paper-H8	PHYSICAL (Practical)	This course will impart skills and knowledge in determination of the concentration of a supplied solution by surface tension method, by viscosity method. Students also learn how to determine partition coefficient of ammonia, to determine of $E^0_{Fe^{3+}/Fe^{+2}}$ by potentiometric titration of Fe^{2+} with dichromate and concentration of unknown iron solution. Students are also demonstrating the verification of Freundlich's adsorption isotherm by study of the adsorption of acetic acid solution on activated charcoal and determination of concentration of acetic acid of unknown strength. They are also skilled how to determine the concentration of salts and mixed acids by

		conductometric method. Students have scope to verify Beer's law and determine the concentration of supplied unknown solution. Students get the idea how to determine the rate constant of acid catalyzed hydrolysis of ethyl acetate ester at room temperature and the rate constant of iodination of acetone.
	GREEN (Practical)	This course will impart skills and knowledge in preparation of inorganic coordination compounds by green method and acetylation of primary amine by using aniline, glacial acetic acid and zinc dust catalyst. They will get idea about green method, green reagents, green solvents, atom economy and sustainable development through practical application.
	INDUSTRIAL (Practical)	Students have the scope to demonstrate the [4+2] cycloaddition reaction (Diels-Alder reaction between furan and maleic acid using water as solvent), base catalyzed aldol condensation (synthesis of dibenzalpropanone) in practical. Students are also trained on Column chromatography, a separation techniques through which reactions products can be separated. Students will learn about the synthesis procedure and purification of different compounds from mixed products.