

## Course outcomes of Chemistry

Year	Paper	Course	
Sem 1	Inorganic Chemistry-1, CEMA CC-1-1-Th	CO1	<p>1. Idea about the structure of atoms, Pauli's Exclusion Principle, Hund's rules and multiplicity, Aufbau principle, Term symbols of atoms and ions.</p> <p>2. Idea of various types of acid-base concept, Pauling's rules, leveling effect of solvents, Drago-Wayland Equation, Superacids, HSAB principle, pH, buffer, Acid-base neutralisation curves; indicator, choice of indicators.</p> <p>3. Get elementary idea on standard redox reactions, Nernst equation, redox potentials on complex formation, precipitation and change of pH, redox indicators, redox potential diagram and their applications and various types of electroanalytical methods. The solubility product and common ion effect.</p>
	Inorganic Chemistry-1, CEMA CC-1-1-P	CO2	<p>1. Estimation of carbonate, bicarbonate, hydroxide and free alkali in mixture.</p> <p>2. Estimation of Fe(II/III), Cu(II), Mn(II) in a mixture by oxidation – reduction titrations.</p>

	Organic Chemistry 1A	CO3	<p>1. Idea of shapes &amp; hybridisation, of molecules, resonance, inductive effect, field effect, mesomeric effect, resonance energy, bond polarization and bond polarizability, electromeric effect, steric effect.</p> <p>2. MO theory, bonding and antibonding interactions, concept of HOMO, LUMO and SOMO; Concepts of aromaticity, antiaromaticity, homoaromaticity; non-aromatic molecules; Frost diagram.</p> <p>3. Knowledge of VBT and MOT, hybridization on bond properties: bond dissociation energy (BDE) and bond energy; bond distances, bond angles, polarity of molecules and dipole moments; relative stabilities of isomeric hydrocarbons.</p> <p>4. Knowledge of ionic, radical and pericyclic reaction mechanism; addition, elimination and substitution reactions type, nature of bond cleavage and bond formation, curly arrow rules in representation of mechanistic steps; reagent type: electrophiles and nucleophiles (elementary idea).</p>
	Organic Chemistry-1, CEMA CC-1-2-P	CO4	Separation of binary mixture of solids based upon solubility, purification of any one of the separated components by crystallization and determination of its melting point.
	Physical Chemistry-1	CO5	<p>1. Fundamental concept of basics physical chemistry, concept of Kinetic Theory and Gaseous state: General treatment of Maxwell's distribution of speed and energy, Concept of Real gases and equation.</p> <p>2. Transport processes such as Diffusion and Viscosity.</p>

			3. Basic concepts of chemical kinetics, different reactions order, temperature dependence of rate constants and Homogeneous catalysis.
	PHYSICAL CHEMISTRY, CEMA-CC1-2-P	CO6	1. Study of kinetics of decomposition of H <sub>2</sub> O <sub>2</sub> , Ester. 2. Study of viscosity of unknown liquid (glycerol, sugar) with respect to water. 3. Determination of solubility of sparingly soluble salt.
	Organic Chemistry 1B	CO7	1. Concepts of stereochemistry: Bonding geometries of carbon compounds: concept of asymmetry; Fischer, sawhorse, flying wedge and Newman projection formulae and their inter translations. Concept of chirality and symmetry. 2. Reaction Mechanism, Reactive intermediates: carbocations, nonclassical carbocations, carbanions, carbon radicals, carbenes.
	Organic Chemistry: (1B) P	CO8	Determination of boiling point of organic liquids.
Sem 2	Organic Chemistry-2, CEMA CC-2-3-Th	CO9	1. Stereochemistry: mainly chirality arising out of stereoaxis, concept of prostereoisomerism, conformation. 2. Reaction thermodynamics, Tautomerism, Reaction kinetics, Substitution and Elimination Reactions, Free-radical substitution reaction.
	Organic Chemistry-2, CEMA CC-2-3-P	CO10	Organic Preparations, yield percentage calculation
	Inorganic	CO11	1. Chemical bonding: geometry and shape of the molecules, various

	Chemistry, CEMA CC- 2-4-Th		<p>properties of ionic and covalent compounds. (i) Ionic bond: size effects, radius ratio rule and its application, Packing of ions in crystals. Born-Landé equation, Born-Haber cycle, Solvation energy. (ii) Covalent bond: Polarizing power and polarizability, ionic potential, Fajan's rules, Lewis structures, formal charge. Valence Bond Theory, Bent's rule, Dipole moments, VSEPR theory.</p> <p>2. Idea about MO concept of bonding and MO diagrams of some homonuclear and heteronuclear diatomic molecules, qualitative idea of valence bond and band theories. hydrogen bonding, receptor-guest interactions etc.</p> <p>3. Radioactivity idea of Nuclear models: concept of nuclear quantum number, magic numbers. Types of different types of nuclear reactions such as artificial radioactivity, transmutation of elements, fission, fusion and spallation. radio carbon dating, age of rocks and minerals, hazards of radiation.</p>
	Inorganic Chemistry, CEMA CC- 2-4-P	CO12	<p>1. Estimation of vitamin C, arsenite, antimony, available chlorine in bleaching powder iodometrically.</p> <p>2. Estimation of Cu in brass, Cr and Mn in Steel and Fe in cement.</p>
Sem 3	Physical chemistry-2 CEMA-CC-3-5- TH	CO13	<p>1. Concept of Chemical Thermodynamics including the laws of thermodynamics and the applications of thermodynamics.</p> <p>2. It gives the idea of Electrochemistry.</p>
	Physical chemistry-2 CEMA-CC-3-5-	CO14	Experiment dealing with instruments such as conductometer, potentiometer and calorimeter.

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Inorganic chemistry -3 CEMA-CC-3-6-TH	CO15	<p>1. Idea of modern periodic table, measurement of screening constant, electronegativity, relativistic effect, inert pair effect and group trends.</p> <p>2. The chemistry of reactivity and relative stability of s and p block elements and their corresponding compounds</p> <p>3. The chemistry of noble gases especially xenon and their compounds are known.</p> <p>4. Knowledge of some inorganic and organic polymers with synthesis, structural aspects and applications.</p> <p>5. IUPAC nomenclature and Isomerism of various types of coordination compounds, Werner's theory of coordination complexes, different types of ligands.</p>
Inorganic chemistry -3 CEMA-CC-3-6-P	CO16	<p>1. Separation of the selective metal ions from its binary mixture by complexometric titration and paper chromatographic Separation</p> <p>2. Estimation of the Ni(II) using dimethylglyoxime (DMG), copper as CuSCN, Al(III) as Al(oxine)<sub>3</sub>(aluminiumoxinate) by gravimetry.</p>
Organic chemistry -3 CEMA-CC-3-7-TH	CO17	<p>1. chemistry of alkenes and alkynes and the name reactions involved and idea about Electrophilic aromatic substitution, and Nucleophilic aromatic substitution</p> <p>2. Learning the chemistry of carbonyl compounds in detail and depth including reactions involving exploitation of acidity of <math>\alpha</math>-H of C=O</p> <p>3. Chemistry of Organometallics, including Grignard reagents, organolithiums etc.</p>
Organic	CO18	1. Learn to identification of pure

	chemistry -3 CEMA-CC-3-7-P		organic compounds (solids/liquids) by systematic and special tests 2. quantitatively estimate organic compounds like glycine, glucose, sucrose etc.
	Sec 2 (analytical clinical biochemistry)	CO19	1. Biomolecules like carbohydrates, proteins, lipids, enzymes, lipoproteins and their biochemical nature. 2. As an analytical tool, analysis of samples of blood and urine systematically. 3. Qualitatively and quantitatively learn the techniques of estimation of carbohydrates, cholesterol, proteins, nucleic acids etc.
Sem4	Organic chemistry-4 CEMA-CC-4-8-TH	CO20	1. Learn about the Chemistry of nitrogen compounds involving preparation and reactions of amines, nitro compounds, alkyl nitriles and isonitriles, diazonium salts etc. 2. Rearrangement reactions involving migration to electron deficient nitrogen atoms and allied systems 3. Retrosynthetic analysis: disconnections; synthons, strategy of ring synthesis, asymmetric synthesis etc. 4. Organic spectroscopy: basic facts and formula followed by problem solving of structure of organic compounds by the application of the knowledge of UV-VIS, IR and NMR spectroscopy.
	Organic chemistry-4 CEMA-CC-4-8-P	CO21	Learn the techniques of Qualitative Analysis of Single Solid Organic Compounds
	Physical chemistry - 3 CEMA-CC-4-9-TH	CO22	1. Various applications of chemical thermodynamics such as colligative properties and phase equilibria. 2. Concept of fundamentals of

			<p>Quantum mechanics with special emphasis of the concept of operators, commutation of operators with examples such as particle in a box.</p> <p>3. Fundamentals of crystallography and crystal structure.</p>
Physical chemistry - 3 CEMA-CC-4-9-P	CO23		Experimental techniques such as polarimetry, thermometry with phenolwater system and pH-metry.
Inorganic chemistry-4 CEMA-CC-4-10- TH	CO24		<p>1. Explanation of the relative stability of different d-orbital splitting energy levels of different geometry, spectrochemical series, magnetism and colour with the help of crystal field theory. L-S coupling, Orgel diagram and its transition, spectral transition rule and charge transfer spectra.</p> <p>2. General characteristics and properties of 3d, 4d, and 5d transition elements.</p> <p>3. Electronic configuration, oxidation states, colour, spectral and magnetic properties of lanthanides and actinides.</p> <p>4. The idea of inorganic substitution reaction of square planar and octahedral complexes and the thermodynamic and kinetic stability are also imported to students.</p>
Inorganic chemistry-4 CEMA-CC-4-10- P	CO25		<p>1. Preparation of selective inorganic coordination complexes.</p> <p>2. determination of <math>10Dq</math> by spectrophotometric method and <math>\lambda_{max}</math> value of <math>[Mn(acac)_3]</math> and <math>[Fe(acac)_3]</math> complexes</p>
Sec 3 (pharmaceuticals chemistry)	CO26		Emphasis of drugs and pharmaceuticals of representative class analgesics agents, antipyretic agents, anti-inflammatory agents and

			antiviral agents (Central Nervous System agents, Cardiovascular, antilepsy, HIV-AIDS related drugs)
Sem5	Physical chemistry - 4 CEMA-CC-5-11- TH	CO27	1. Concept of the various quantum mechanical systems such as simple harmonic oscillator, Hydrogen atom problem and also understand the concept of chemical bonding with theories such as LCAO and BornOppenheimer approximation, MO theory. 2. Concept of Statistical Thermodynamics. 3. Numerical analysis with ideas about different numerical methods with applications in chemistry.
	Physical chemistry - 4 CEMA-CC-5-11- P	CO28	Computer programs (Using FORTRAN or C or C++) based on numerical methods.
	Organic chemistry - 5 CEMA-CC-5-12- TH	CO29	1. Chemistry of polynuclear aromatic hydrocarbons and their derivatives, their preparation, conformation and reactivity of alicyclic compounds 2. Mechanism, stereochemistry, regioselectivity of pericyclic reactions 3. Idea of biomolecules like carbohydrates and amino acids, proteins, nucleic acids-their basic chemistry, preparation
	Organic chemistry - 5 CEMA-CC-5-12- P	CO30	1. Learn Chromatographic separation techniques. 2. Analysis of organic spectra to solve structural problems on organic compounds.
	DSE-A-2: Applications of computers in chemistry	CO31	1. Learn Computer Programming Basics on (FORTRAN): 2. Spreadsheet Software (MS Excel) 3. Analysis of the Statistical data by T test and the F test. 4. Practicals.
	DSE-B-1:	CO32	1. Discussion about the Silicate



	Inorganic materials of industrial importance		Industries, Fertilizers, Surface Coatings on the materials and their application. 2. Introduction of Solidstate electrolyte, battery, Fuel cells, Solar cell and polymer cell. 3. Different catalysis and their activity in industrial application and introduction about explosives. 4. Practical application of the materials
Sem 6	Inorganic chemistry-5 CEMA-CC-6-13- TH	CO33	1. Know the role and functions of metal ions (specially Na <sup>+</sup> , K <sup>+</sup> , Mg <sup>2+</sup> , Ca <sup>2+</sup> , Fe <sup>3+/2+</sup> , Cu <sup>2+/+</sup> , and Zn <sup>2+</sup> ), metalloproteins and chelation effect of some metals (Pt, Au) as drugs for different diseases. 2. It gives the idea of structure and chemistry of several organometallic complexes.
	Inorganic chemistry-5 CEMA-CC-6-13- P	CO34	Identification the compositions (basic and acid radical) of unknown inorganic mixtures by qualitative semimicroanalysis.
	Physical chemistry-5 CEMA-CC-6-14- TH	CO35	1. Learn the Concept of Molecular spectroscopy such as rotational and vibrational spectroscopy, surface phenomena such as adsorption, surface tension and colloids. 2. Learning of the concept of Photochemistry and Theory of reaction rate. 3. Development of concept on Dipole moment and polarizability.
	Physical chemistry-5 CEMA-CC-6-14- P	CO36	Experiments involving colorimetry, spectrophotometry and experiments related to surface tension as well as determination of CMC of micelles.
	DSE-A-3: Green chemistry and chemistry of	CO37	1. Discussion about the green chemistry and green synthesis the future trends of green chemistry for sustainability.

	natural products		<p>2. Acquire knowledge on the chemistry of natural compounds like terpenes and alkaloids.</p> <p>3. Carry out six green syntheses in the laboratory</p>
	DSE-B4: Dissertation	CO38	<p>1. Carry out research /review on a topic as assigned.</p> <p>2. Preparation of project report and digital presentation</p>