

COURSE OUTCOME
CHEMISTRY HONOURS
SEMESTER 1
CEMA-CC-1-1-TH
INORGANIC CHEMISTRY-1

From this Core Course students will learn:

- Precipitation and redox reaction: Redox reactions which consists of elementary idea on standard redox potentials with sign conventions, Nernst equation, influence of complex formation, precipitation and change of P^H on Redox potentials, formal potential, redox titration, redox indicator, comproportionation and disproportionation reaction Latimer and Frost diagram, ion-electron method of balancing equation of redox reaction, P^H metric, potentiometric, conductometric titrations.
- Extra nuclear struture of atom which consists of quantum numbers, Schrodinger wave equation, radial and angular wave functions, radial and angular distribution curve,Pauli, Hund and Aufbau principle, ground state term symbol.
- Acid baseAcid-Base concept: Arrhenius concept, theory of solvent system, Bronsted-Lowry'sconcept, relative strength of acids, Pauling's rules. Lux-Flood concept, Lewis concept, group characteristics of Lewis acids, solvent leveling and differentiating effects. HSAB principle. Acid-base equilibria in aqueous solution (Proton transfer equilibria in water), pH , buffer. Acid-base neutralisation curves; indicator, choice of indicators.
- Solubility and solubility effect – common ion effect and their applications to the precipitation and separation of common metallic ions as hydroxides, sulfides, phosphates, carbonates, sulfates and halides.

ORGANIC CHEMISTRY-1A

- Students will have a clear idea about Valence bond theory, electronic displacements and Molecular orbital theory from this part. Concept of aromaticity, antiaromaticity and homoaromaticity are also discussed here.
- The students can understand different physical properties like bond dissociation energy, bond distances, bond angles, melting point/ boiling point, polarity and relative stabilities of hydrocarbons.
- Basic concept of reaction mechanism is discussed in this part.

CEMA-CC-1-1-P

INORGANIC CHEMISTRY: I (1) LAB

- Acid base titrations which consist of estimation of carbonate and hydroxide, estimation of carbonate and bicarbonate in a mixture, estimation of free alkali present in different soaps/detergents.
- Oxidation - reduction titrations which consists of permanganometry, dichrometry iodometry and iodimetry titrations.

ORGANIC CHEMISTRY: O (1A) LAB

- From this particular practical course students will learn how to separate some particular organic solid mixtures on the basis of their solubility in various organic and inorganic solvents.

CEMA-CC-1-2-TH
PHYSICAL CHEMISTRY-1

From this course...

- The basic concept of Kinetic Theory of gases, behavior of real gases can be understood.
- Rate of a chemical reaction and its order and molecularity can be learned
- Catalysts and its mechanism of function, Enzyme catalysis, Homogeneous catalysis etc. can be assessed.
- The fundamental concept of transport processes such as diffusion, viscosity can be analyzed.

ORGANIC CHEMISTRY-1B

At the end of this course:

- Students will understand the stereochemistry of organic compounds such as how to represent the three dimensional geometry through various projection formulas and also their relative and absolute configuration. Their concept of chirality, optical activity and symmetry of organic compounds will be enriched.
- The students can understand the fundamental reaction mechanism of organic reactions through the study of various organic reactive intermediates such as carbocation, carbanion, organic radical and carbenes.

CEMA-CC-1-2-P

PHYSICAL CHEMISTRY-1(LAB)

From this course students will know:

- Study of kinetics of decomposition of H_2O_2 , acid catalyzed hydrolysis of methyl acetate.
- Study of viscosity, determination of solubility product of sparingly soluble salt.

ORGANIC CHEMISTRY:O (1B) LAB

- From this particular practical course students will learn to determine the boiling points of some specific organic liquids.

SEMESTER 2

CEMA-CC-2-3-TH

ORGANIC CHEMISTRY-2

From this course students will learn:

- Students will have a brisk idea of axial chirality and their presence in different organic systems. They will be able to assign the configurational description to the compounds and the stereochemistry of biphenyl systems.
- A clear concept on the prochirality, prostereoisomerism and topicity of organic compounds will be obtained.
- Students can know the difference between conformation and configuration, and the stability of various organic compounds on the basis of conformational analysis.
- The basic concept of Kinetic isotope effect in organic reactions, different reaction mechanisms and tautomerism can be understood.
- Students will know different types of substitution reactions (free radical and nucleophilic) along with their mechanistic pathways.
- The students can have a clear idea about variety of 1, 2 Elimination reactions.

CEMA-CC-2-3-P

ORGANIC CHEMISTRY-2(LAB)

From this particular course students will be able to prepare some organic compounds by following reactions:

- Condensation reactions
- Hydrolysis of amides/imides/esters

- Diazo coupling reactions of aromatic amines
- Selective reduction of m-dinitrobenzene to m-nitroaniline
- Bromination of anilides using green approach (Bromate-Bromide method)
- Acetylation of phenols/aromatic amines

CEMA-CC-2-4-TH

INORGANIC CHEMISTRY-2

From this Core Course students will learn:

- General Characteristics of ions, types, size, packing, radius ratio rule relating to Born-Landé equation, Born-Haber cycle, Madelung constant, an elementary idea about defects of crystal.
- Covalent bonding relating to Fajan's rule, Valence bond theory, Bent's rule, hybrid orbital and VSEPR theory depicting shapes of molecules with lone pairs and bond pairs.
- The molecular orbital concept of bonding based on Linear Combination of Atomic Orbital theory; sigma and pi-bonds and delta interaction, multiple bonding; Orbital designations: gerade, ungerade, HOMO, LUMO. Orbital mixing; MO diagrams of various homonuclear (H_2 , Li_2 , Be_2 , B_2 , C_2 , N_2 , O_2 , F_2) and Heteronuclear molecular orbitals (CO , NO , NO^+ , CN^- , HF , BeH_2 , CO_2 and H_2O) along with their bond properties like bond orders, bond lengths.
- The Metallic bonding based on qualitative idea of valence bond and band theories, semiconductors and insulators, defects in solids, theories of hydrogen bonding, receptor-guest interactions, Halogen bonds, effects of chemical force, melting and boiling point.
- Radioactivity, fundamental concepts of Decay Law, Half-life, Radioactive series, Nuclear model, magic number, different nuclear reactions, nuclear reactor.
- The uses of radio isotopes, radio carbon dating, artificial radioactivity, transmutation of elements, hazards of radiation and safety measures.

CEMA-CC-2-4-P

INORGANIC CHEMISTRY-2(LAB)

From the practical part students will be able to estimate the following substances:

- Vitamin C
- Arsenic and Antimony iodometrically
- Available chlorine in bleaching powder
- Cu in brass
- Cr and Mn in steel
- Fe in cement

SEMESTER 3

CEMA-CC-3-5-TH

PHYSICAL CHEMISTRY-2

From this course:

- The basic concept of thermodynamics, heat-work relation, enthalpy, entropy can be learned.
- From thermo-chemistry part enthalpy of formation/combustion/neutralization, bond dissociation energy etc. can be assessed
- Thermodynamics and its importance in chemical equilibrium, systems of variable composition can be analyzed
- Conductance of weak and strong electrolytes, Debye-Hückel theory of ion conductance, conductometric titrations, Transport number can be understood

- Different kinds of electrochemical cells and their functions, electro motive force calculation can be assessed

CEMA-CC-3-5-P

PHYSICAL CHEMISTRY-2

- In the Practical part: Use of conductometry in the titration of an acid base, saponification, potentiometric titration, solubility product determination reaction can be learned.

CEMA-CC-3-6-TH

INORGANIC CHEMISTRY-3

From this core course students will be able to know about

- Modern IUPAC Periodic table, effective nuclear charge, screening effect, Slater's rule, atomic radii, ionic radii, ionization potential, electron affinity and electronegativity, factors influencing these properties, group trends and periodic trends in these properties in respect of s, p and d block elements, secondary periodicity, relativistic effect, inert pair effect, Pauling, Mulliken and Allred- Rochow's electronegativity scales;
- Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Hydrides and their classification ionic, covalent and interstitial. Basic beryllium acetate and nitrate. Study of the various compounds with emphasis on structure, bonding, preparation, properties and uses.
- Occurrence, uses, rationalization of inertness of noble gases, Clathrates; preparation and properties of XeF₂, XeF₄ and XeF₆; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF₂ and XeF₄). Xenon-oxygen compounds. Molecular shapes of noble gas compounds (VSEPR theory).

- Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes, borazines, silicates and phosphazenes;
- Coordinate bonding, Werner's theory of coordination complexes, Classification of ligands, IUPAC nomenclature of coordination complexes, Isomerism in coordination compounds, Geometrical and optical isomerism in square planar and octahedral complexes.

CEMA-CC-3-6-P

INORGANIC CHEMISTRY-3

- From the practical course students will be able to do complexometric titration of Zn(II), Zn(II) in a Zn(II) and Cu(II) mixture, Ca(II) and Mg(II) in a mixture, Hardness of water, Al(III) in Fe(III) and Al(III) in a mixture; Paper chromatographic separation of Ni (II) and Co (II), Fe (III) and Al (III); Gravimetric estimation of Ni(II) using Dimethylglyoxime (DMG), copper as CuSCN, Al(III) by precipitating with oxine and weighing as Al(oxine) 3 (aluminiumoxinate), chloride.

CEMA-CC-3-7-TH

ORGANIC CHEMISTRY-3

At the end of this course:

- Students will learn different types of addition reactions of alkenes from this course. Addition reactions of conjugated dienes and allene are also discussed here.
- The students can understand the addition reactions of alkynes from this part.
- The knowledge of different types of aromatic substitution reactions, both electrophilic and nucleophilic are clearly understood from this course.
- Students will come to know about the bonding and reactivity of carbonyl group specially addition, oxidation and reduction reactions.
- They will learn the various reactions exploiting the acidity of α -H of carbonyl group and nucleophilic addition to α,β -unsaturated carbonyl system.
- Students will get basic idea about structure and reactivity of organometallic compounds.

CEMA-CC-3-7-P

ORGANIC CHEMISTRY-3

- From this particular practical course students will be able to identify some particular organic liquids and solids by means of special tests.
- Students will learn to estimate quantitatively some amino acids, aromatic amine, acetic acids, urea and saponification value of oil/fat/ester.

SEC 2

ANALYTICAL CLINICAL BIOCHEMISTRY

- The students will have an idea about the biological importance of carbohydrates which includes metabolism, glycolysis etc along with isolation and characterization of polysaccharides.
- Classification, biological importance and structure of proteins including denaturation are clearly discussed in this part.
- The chemistry of enzymes and biocatalysis are discussed here.
- The students will learn biological importance of lipids and lipoproteins from this course.
- The structure of nucleic acids and their activities are discussed in details.
- Biochemistry of disease, a diagnostic approach by blood/ urine analysis is discussed in this course.
- Identification and estimation of carbohydrates[qualitative and quantitative], lipids [qualitative], iodine number of oil determination, saponification number of oil determination and determination of cholesterol using Liebermann- Burchard reaction are discussed in practical part.

SEMESTER 4
CEMA-CC-4-8-TH
ORGANIC CHEMISTRY-4

From this Core Course, students will learn about:

- Preparation of different aliphatic and aromatic nitrogenous compounds like amines, nitro, cyanides, isocyanides and diazonium salts and their important reactions and separation of primary, secondary and tertiary amines from their mixture.
- The importance of aromatic diazonium compounds in preparation of many important organic compounds, particularly substituted benzene.
- Different types of rearrangement reactions are clearly understood from this course.
- How to design a target organic molecule to synthesize and prepare the strategy in a logical manner by disconnection approach. This particular course will develop the synthetic skills of the students and make the foundation of future organic synthetic chemist.
- Organic spectroscopy is a branch which is very important to diagnosis the kind of bonding, functional group present in an unknown organic molecule. Students will have a profound knowledge about the basic theory of UV-Vis, Infrared and ^1H NMR spectroscopy.
- By combining all the three types of spectroscopy mentioned in the course students will be capable to identify an organic compound if the molecular formula and the spectral data are provided.

CEMA-CC-4-8-P

ORGANIC CHEMISTRY-4

- From this particular course students will be able to identify an organic compound by means of different qualitative chemical tests.
- Students can detect the presence of special elements like N, S, Cl, Br in the given compound.
- They can classify the organic compound into acidic, basic or neutral in nature on the basis of solubility.
- Students can confirm the presence of the functional groups by some systematic qualitative analysis.
- Student will have a practical knowledge how to purify an organic compound by crystallization.
- From recording the melting point of the pure organic compound and literature survey students will be able to identify the exact compound from the list of possible compounds.

CEMA-CC-4-9-TH

PHYSICAL CHEMISTRY-3

From this Core Course, students will know about:

- The importance different colligative properties of solution irrespective of the nature of the solvent.
- The concept of phase diagram and its application in solid-liquid, Liquid-liquid, Solid-solid binary solution, Alloys and Eutectic mixtures,

- Different modes of crystal packing of the ions and atoms in solid crystal can from the crystal structure
- The basic concept of quantum mechanics such as Black body radiation, Particle in one dimensional box can be learned from the course and its future implication in determining electronic state in an atom/molecule
- The fundamental concepts of quantum mechanical operators, Hamiltonian operators, well behaved wave functions and their importance in the quantum mechanics.
- A brief idea of the theory behind the specific heat of solid (i.e. Dulong Petit's law, Debye T³ law can be understood from the Specific heat of solid chapter.

CEMA-CC-4-9-P

PHYSICAL CHEMISTRY-3

From this practical course students will be able to know:

- Use of Polarimeter to check the kinetic inversion of cane sugar.
- Phase diagram for Phenol-water binary system.
- pH metric titration of mono-basic, di-basic and tri-basic acid vs. strong base and their dissociation constant.
- Partition Coefficient for the distribution of iodine in water and organic layer.

CEMA-CC-4-10-TH

INORGANIC CHEMISTRY-4

From this Core Course, students will know about:

- Elementary Crystal Field Theory: splitting of d n configurations in octahedral, square planar and tetrahedral fields, crystal field stabilization energy (CFSE) in weak and strong

fields; Spectrochemical series, Jahn- Teller distortion, Metal-ligand bonding, sigma- and pi-bonding in octahedral complexes.

- Magnetism and Colour: Orbital and spin magnetic moments, spin only moments of d n ions and their correlation with effective magnetic moments, quenching of magnetic moment: super exchange and anti-ferromagnetic interactions; L-S coupling; qualitative Orgel diagrams, elementary idea about Selection rules for electronic spectral transitions.
- A comparative study of 3d, 4d and 5d transition elements in terms of electronic configuration, oxidation states, redox properties and coordination chemistry.
- A comparative study of electronic configuration, oxidation states, colour, spectra and magnetic properties of lanthanides and actinides. Lanthanide contraction and separation of lanthanides.
- At the end of the topic (Reaction Kinetics and Mechanism), students will be able to recognize the correct methods for the assumption of inorganic reaction mechanism. They will understand the different mechanisms for substitution of octahedral and square planar complexes. They will be able to know the Trans-effect and its application in complex synthesis, theories of Trans-effect.
- Students will be able to know Thermodynamic and Kinetic stability. Kinetics of substitution. Ligand field effect and reaction rate. They will also learn different stability constants and their relation.

CEMA-CC-4-10-P

INORGANIC CHEMISTRY-4

From this practical course students will be able to prepare the following inorganic compounds:

- Cis and trans $K[Cr(C_2O_4)_2(H_2O)_2]$
- Tetraamminecarbonatocobalt (III) ion
- Potassium tris(oxalato)ferrate(III)
- Tris-(ethylenediamine) nickel(II) chloride.
- $[Mn(acac)_3]$ and $[Fe(acac)_3]$ (acac= acetylacetonate)

Students will also acquire an idea about these Instrumental Techniques:

- Measurement of $10Dq$ by spectrophotometric method
- Determination of λ_{max} of $[Mn(acac)_3]$ and $[Fe(acac)_3]$ complexes.

SEC 4

PESTICIDE CHEMISTRY

From this Skill Enhancement Course, students will know about:

- Different types of Pesticides which help Farmers to grow crops more efficiently
- The mode of action of Pesticides from various examples discussed in this course.
- The benefits and hazards of Pesticides used in agriculture.
- The reasons for the choice of Bio-pesticides over Chemical pesticides.
- The Structure-Activity Relationship (SAR) study which is important for the development of a new pesticide that would be more efficient in agriculture / household applications .

SEMESTER 5

CEMA-CC-5-11TH

PHYSICAL CHEMISTRY-4

From this course

- The students can analyze application of quantum mechanics in simple harmonic motion, One dimensional Schrödinger equation and its of solution
- Importance of Schrodinger equation for rigid rotator model of rotation of diatomic molecule, Separation of variables, Spherical harmonics can be assessed.
- Setting up of Schrödinger equation in for Hydrogen atom can be learned and its importance for the advancement of quantum chemistry can be understood
- From the statistical thermodynamics part microstates, macrostates, partition function, the importance of statistical thermodynamics in bridging between quantum and thermodynamics can be learned

CEMA-CC-5-11P

PHYSICAL CHEMISTRY-4

- From the practical part the application FORTRAN programming in chemistry such as numerical integration, differentiation, root of equation can be analyzed.

CEMA-CC-5-12TH

ORGANIC CHEMISTRY-5

At the end of this course:

- Students will learn the chemistry of polynuclear hydrocarbon and their derivatives. An elaborative discussion regarding the biological importance, synthesis and reactivity of heterocyclic compounds have also been made in this section.
- The students can understand the stereochemistry of alicyclic compounds, mainly cyclohexane and stereochemistry involved in various reactions like substitution, elimination in these types of compounds.
- The knowledge of different types of pericyclic reactions like cycloaddition, electrocyclic and sigmatropic reactions will be enriched.
- The students will have an idea about carbohydrate compounds, both monosaccharides and disaccharides from this part.
- The chemistry of amino acids, peptides and nucleic acids are discussed in details in this course.

CEMA-CC-5-12-P

ORGANIC CHEMISTRY-5

- From this particular practical course students will be able to separate mixture of coloured organic compounds like amino acids, dyes and sugars by means of thin layer and paper chromatography.
- Students will be able to apply their knowledge on IR, ¹H NMR spectroscopy through analysis these spectra of various organic compounds.

DSE-B-1-TH

INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

From this Discipline Specific Course, students learn about

- Different types of alloys, Specific properties of elements in alloys. Various processes involved in manufacture of Steel like removal of silicon decarbonization, demanganization, desulphurization dephosphorisation, surface treatment (Arand heat treatment, nitriding, carburizing), Composition and properties of different types of steels.
- General principles and properties of catalysts, homogenous and heterogenous catalysis and their industrial applications, Deactivation or regeneration of catalysts, Phase

transfer catalysts, application of zeolites as catalysts; Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX), Introduction to rocket propellants.

- Students will know about different types of fertilizers, surface coatings where they will get idea about different types of paints, dyes, wax polishing, metallic coating, metal spraying and anodizing. Students will also know about different types of batteries.
- Students will know about silicate industries which consists of glass, cements and ceramics.

PRACTICALS-DSE-B-1:

- Students will be able to know how to determine free acidity in ammonium sulphate fertilizer, how to estimate calcium and phosphoric acid in fertilizer, electroless metallic coating on ceramic and plastic material.
- Students will know the method of determination of composition of dolomite, analysis of Cu, Ni, Zn in alloys, analysis of cement, preparation of pigment.

DSE-A-2-TH

APPLICATIONS OF COMPUTERS IN CHEMISTRY

From this course students will learn:

- Computer programming basics (FORTRAM)
- Introduction to spreadsheet software (MS Excel)
- sssStatistical analysis

PRACTICALS-DSE-A-2:

- In this practical part students will learn plotting of graphs using a spreadsheet.

- Students will be able to know the use of spreadsheet to solve the 1D Schrodinger equation (Numerov method)

SEMESTER 6

CEMA-CC-6-13TH

INORGANIC CHEMISTRY-5

- At the end of the topic (Theoretical Principles in Qualitative Analysis) which will cover the practical part also, students will be able to know how to detect basic radicals or cations and acid radicals or anions. They will be able to detect interfering acid radicals and also be able to understand the necessity and the process of removing the interfering anions before entering Group III. Students will also be able to analyse insoluble materials.
- Students will be able to know the effect of solubility product, common ion effect in the Group analysis of cations.
- Bioinorganic Chemistry actively deals with inorganic reactions occurring “in vivo” in biological systems with special mention to Fe(II), Ca(II), Na⁺, K⁺ ions. For example Haemoglobin, Myoglobin, Hemocyanine and Hemerythrin.
- A brief detail about metal ion induced toxicity overcoming by chelation therapy and some specialised drugs of Pt(II) and Au(II) complexes.
- From the chapter of Organometallic Chemistry, students will understand the application of 18 electrons rule; preparatory methods, structure and bonding of different metal carbonyls, nitrosyls and cyanides; Synergic effect and use of IR data to explain the extent of back bonding in such complexes.
- Students will also be able to know the details of Zeise’s salt, Ferrocene, different reactions of organometallic compounds like oxidative addition, reductive elimination etc. along with different important catalytic and industrial processes like Alkene hydrogenation, Hydroformylation, Wacker process, Fischer Tropsch reaction and Ziegler-Natta catalyst for olefin polymerisation.

CEMA-CC-6-13-P

INORGANIC CHEMISTRY-5

From this practical course

- Students will be able to detect basic radicals or cations and acid radicals or anions from a salt mixture.
- They will be able to detect interfering acid radicals and also be able to understand the necessity and the process of removing the interfering anions before entering Group III.
- Students will also be able to analyse insoluble materials.

CEMA-CC-6-14TH

PHYSICAL CHEMISTRY-5

- The students can analyze light and matter interactions, nature of rotation and vibration in bonds, electronic transition by the various spectroscopic methods (Microwave, IR, UV spectroscopy).
- The students will be able to understand the mechanism of various photo physical (Fluorescence and Phosphorescence) and photochemical processes.
- The inherent contractile nature of the surface of a liquid is can be easily understood and analyse by the study of Surface Tension of a liquid.
- The mechanism of adsorption of gas on the solid surface can be studied from Freundlich, Langmuir and BET adsorption isotherms.
- The origin of dipole moment and polarizability within a molecule can be learned from the Dipole moment and Polarizability chapter
- The concept of Collision theory and its importance in the determination of rate of the reaction can be understood from the collision theory chapter

CEMA-CC-6-14-P

PHYSICAL CHEMISTRY-5

- From the practical part the application surface tension experiments and spectrophotometric method in determining reaction kinetics, pH and Indicator constant can be understood.
- Use of Stalagmometer to determine of surface tension can be learned.
- Validity of Lambert Beer's law, reaction kinetics of particular reaction and pH of unknown buffer solution can be determined by spectro-photometric techniques.
- How surface tension experiment can be helpful to determine CMC of surfactant that can be learned.

DSE-A-3

GREEN CHEMISTRY AND CHEMISTRY OF NATURAL PRODUCTS

At the end of this course:

- Students will learn the basic principles of Green and Sustainable Chemistry.
- They will understand the atom economy, % yield calculations and can apply them in green organic synthesis.
- They can have an idea about the green approaches of the conventional name reactions and rearrangements and get the motivation towards the future trends in Green Chemistry for sustainable development.
- Students will come to know about some important natural products found in plants and other resources.

- They will enrich their knowledge studying the basic principles, structure elucidation process, preparation and reactions of terpenoids and alkaloids.
- Students can get wide information about the natural products used as medicines and to some extent apply them in daily life.

PRACTICALS-DSE-A-3

From this particular course students will be able to prepare some organic compounds by following reactions and build up their foundation of synthetic skills:

- Acetylation of primary amine (preparation of acetanilide).
- Pinacol-pinacolone rearrangement reaction (preparation of benzopinacolone).
- Solid state synthesis of benzilic acid from benzil.
- Benzoin condensation using thiamine hydrochloride as a catalyst instead of potassium cyanide.
- Base catalysed aldol condensation (synthesis of dibenzal propanone from benzaldehyde and acetone).
- Bromination of trans-stilbene using bromide/bromate mixture.

DSE-B-4

DISSERTATION

- Students will gain a knowledge about research work.
- In this paper students will know how to prepare a project report.
- Digital presentation of the project

COURSE OUTCOME
CHEMISTRY GENERAL
SEMESTER 1
CC 1/GE1 TH

From this course students will learn:

- Students will get the basic knowledge on some fundamental concepts of organic chemistry like electronic displacement and the reactive intermediates.
- They will know how to represent the three dimensional structures of organic molecules in two dimensional platforms. Also they will have idea on the relative and absolute configurations of some organic molecules.
- The students will have an idea about chemical kinetics from this part.
- Nucleophilic substitution and elimination reactions are discussed in details.
- Students will be able to know about atomic structure, chemical periodicity where they will get the knowledge of Bohr's theory, quantum numbers, Hund's rule, electronic configuration, atomic size, ionization potential, electro affinity, electronegativity, periodic and group-wise variation of above properties in respect of s and p-block elements.
- Kinetic theory of gases, Maxwell's distribution, Vander Waal's equation, critical constants, liquids, surface tension, viscosity.
- Acid-Base concept: Arrhenius concept, theory of solvent system, Bronsted-Lowry's concept, relative strength of acids, Pauling's rules. Lux-Flood concept, Lewis concept, group characteristics of Lewis acids, solvent leveling and differentiating effects. HSAB

principle. Acid-base equilibria in aqueous solution (Proton transfer equilibria in water), pH, buffer. Acid-base neutralisation curves; indicator, choice of indicators.

CC 1/GE1 P

- From this part students will learn estimation of sodium carbonate and sodium hydrogen carbonate in a mixture, estimation of oxalic acid by KMnO_4 , estimation of Fe(II) by $\text{K}_2\text{Cr}_2\text{O}_7$, estimation of Cu(II) by sodium thiosulphate, estimation of Fe(II) and Fe(III) in a mixture by $\text{K}_2\text{Cr}_2\text{O}_7$.

SEMESTER 2

CC 2/GE2 TH

From this Generic Elective Course students will acquire knowledge about:

- The thermodynamic conditions for equilibrium, variation of free energy with degree of advancement; definitions of K_p , K_c and K_x and relation among them; shifting of equilibrium due to change in external parameters; variation of equilibrium constant with addition to inert gas; Le Chatelier's principle; Ideal solutions and Raoult's law, vapour pressure-composition and temperature-composition curves of ideal and non-ideal solutions; Nernst distribution law and its applications, solvent extraction.
- The Chemistry of Aliphatic Hydrocarbons (Alkanes, Alkenes, Alkynes) are discussed here in details comprised of Preparations and reactions of those compounds.
- The structure and bonding of the solids, different types of crystal systems and some important relationship regarding this chapter to solve numerical problems.
- While recording the experimental data sometimes analysts face the problem of data reproducibility or the data accuracy. Students will be able to classify the errors

and know how to diminish them. Also some basic idea about the hardware and software of computer will grow the interest on modern technology.

- Students will be able to know about redox reactions, redox potential, redox titration, Nernst equation. They will also be able to know about phases, components and degrees of freedom of a system, criteria of phase equilibrium; Gibbs Phase Rule; Derivation of Clausius-Clapeyron equation and its importance in phase equilibria; Phase diagrams of one-component systems (water and CO₂)

CC2/GE2- P

- Determination of Viscosity, Surface tension of unknown liquid, Partition Coefficient and Reaction Kinetics experiments are performed in this course.

SEMESTER 3

CC 3/GE3 TH

- Students will get the basic knowledge on organometallic compounds: particularly Grignard and organozinc reagents. Also they will learn the preparation and reactions of organic halides. They will also learn the chemistry of aromatic hydrocarbons from this course. Students will be able to know about comparative study of p-block elements, coordination chemistry which consists of Werner's coordination theory, valence bond theory, inner and outer orbital complexes, IUPAC nomenclature, structural and stereo isomerism in complexes with coordination numbers of 4 and 6.
- Students will learn about various chemical bonding including ionic and covalent bonding along with molecular orbital approach to build up molecular structure.
- They will also know general group trends of transition elements with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states, electronic configurations of lanthanoids and actinoids, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides.
- Students will also learn about ionic equilibria, conductance and electromotive force from this course.

CC 3/GE3 P

- Students will be able to perform qualitative semimicro analysis of mixtures containing any two radicals from the following: Cation Radicals: Na^+ , K^+ , Ca^{2+} , Sr^{2+} , Ba^{2+} , Al^{3+} , Cr^{3+} , $\text{Mn}^{2+}/\text{Mn}^{4+}$, Fe^{3+} , $\text{Co}^{2+}/\text{Co}^{3+}$, Ni^{2+} , Cu^{2+} , Zn^{2+} , Pb^{2+} , $\text{Sn}^{2+}/\text{Sn}^{4+}$, NH_4^+ . Anion Radicals: F^- , Cl^- , Br^- , BrO_3^- , I^- , IO_3^- , SCN^- , S^{2-} , SO_4^{2-} , NO_3^- , NO_2^- , PO_4^{3-} , AsO_4^{3-} , BO_3^{3-} , $\text{CrO}_4^{2-}/\text{Cr}_2\text{O}_7^{2-}$

SEMESTER 4

CC 4/GE4 TH

From this Generic Elective Course students will have a clear idea about:

- The bonding and reactivity of the carbonyl groups present in aldehydes, ketones, carboxylic acids and their derivatives; preparations and reactions of Alcohols, Phenols and Ethers.
- Preparation of amines by Hofmann degradation, Reaction with HNO_2 , Schotten-Baumann reaction, Diazo coupling reaction, Preparation and reactions of Diazonium salts, reduction of aromatic nitro compounds under different conditions.
- Preparations of amino acids, general properties, zwitterion, isoelectric point, classification and general properties of Carbohydrates; osazone formation, oxidation-reduction reactions; ascending and descending in monosaccharide, mutarotation.
- Crystal Field effect, Crystal Field Stabilization Energy, Crystal Field Effect for weak and strong fields, Crystal Field Splitting in different geometry, factors affecting the magnitude of D, spectrochemical series, tetragonal distortion of octahedral geometry and Jahn-Teller Distortion.
- Basic concept of Quantum mechanics and spectroscopy covering rotational and vibrational motions of the molecules.

CC 4/GE4 P

- Students can detect the presence of special elements like N, S, Cl, Br in the given compound.
- They can classify the acidic, basic or neutral nature of the supplied compound on the basis of solubility.
- Students can confirm the presence of the functional groups by means of different qualitative chemical tests.
- Student can identify some pure solid and liquid organic compounds by performing some special chemical analysis.

SEMESTER 5

DSE-A-2

INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

From this Discipline Specific Course, students learn about

- Different types of alloys, Specific properties of elements in alloys. Various processes involved in manufacture of Steel like removal of silicon decarbonization, demanganization, desulphurization dephosphorisation, surface treatment (Arand heat treatment, nitriding, carburizing), Composition and properties of different types of steels.
- General principles and properties of catalysts, homogenous and heterogenous catalysis and their industrial applications, Deactivation or regeneration of catalysts, Phase transfer catalysts, application of zeolites as catalysts; Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX), Introduction to rocket propellants.
- Students will know about different types of fertilizers, surface coatings where they will get idea about different types of paints, dyes, wax polishing, metallic coating, metal spraying and anodizing. Students will also know about different types of batteries.

- Students will know about silicate industries which consists of glass, cements and ceramics.

PRACTICALS-DSE-A-2:

- Students will be able to know how to determine free acidity in ammonium sulphate fertilizer, how to estimate calcium and phosphoric acid in fertilizer, electroless metallic coating on ceramic and plastic material.
- Students will know the method of determination of composition of dolomite, analysis of Cu, Ni, Zn in alloys, analysis of cement, preparation of pigment.

SEC 2

ANALYTICAL CLINICAL BIOCHEMISTRY

- The students will have an idea about the biological importance of carbohydrates which includes metabolism, glycolysis etc along with isolation and characterization of polysaccharides.
- Classification, biological importance and structure of proteins including denaturation are clearly discussed in this part.
- The chemistry of enzymes and biocatalysis are discussed here.
- The students will learn biological importance of lipids and lipoproteins from this course.
- The structure of nucleic acids and their activities are discussed in details.
- Biochemistry of disease, a diagnostic approach by blood/ urine analysis is discussed in this course.
- Identification and estimation of carbohydrates[qualitative and quantitative], lipids [qualitative], iodine number of oil determination, saponification number of oil

determination and determination of cholesterol using Liebermann- Burchard reaction are discussed in practical part.

SEMESTER 6

DSE-B-1

GREEN CHEMISTRY AND CHEMISTRY OF NATURAL PRODUCTS

At the end of this course:

- Students will learn the basic principles of Green and Sustainable Chemistry.
- They will understand the atom economy, % yield calculations and can apply them in green organic synthesis.
- They can have an idea about the green approaches of the conventional name reactions and rearrangements and get the motivation towards the future trends in Green Chemistry for sustainable development.
- Students will come to know about some important natural products found in plants and other resources.
- They will enrich their knowledge studying the basic principles, structure elucidation process, preparation and reactions of terpenoids and alkaloids.
- Students can get wide information about the natural products used as medicines and to some extent apply them in daily life.

PRACTICALS-DSE-B-1

From this particular course students will be able to prepare some organic compounds by following reactions and build up their foundation of synthetic skills:

- Acetylation of primary amine (preparation of acetanilide).
- Pinacol-pinacolone rearrangement reaction (preparation of benzopinacolone).
- Solid state synthesis of benzoic acid from benzil.

- Benzoin condensation using thiamine hydrochloride as a catalyst instead of potassium cyanide.
- Base catalysed aldol condensation (synthesis of dibenzal propanone from benzaldehyde and acetone).
- Bromination of trans-stilbene using bromide/bromate mixture.

SEC 4

PESTICIDE CHEMISTRY

From this Skill Enhancement Course, students will know about:

- Different types of Pesticides which help Farmers to grow crops more efficiently
 - The mode of action of Pesticides from various examples discussed in this course.
 - The benefits and hazards of Pesticides used in agriculture.
 - The reasons for the choice of Bio-pesticides over Chemical pesticides.
 - The Structure-Activity Relationship (SAR) study which is important for the development of a new pesticide that would be more efficient in agriculture / household applications .
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