

## **DEPARTMENT OF CHEMISTRY**

### **B.Sc. GENERAL CHEMISTRY (CEM-G)**

#### **CC1/GE1**

Students learn about theoretical knowledge of kinetic theory of ideal and real gases, surface tension and viscosity of liquid, kinetics of different types of chemical reactions, concept of atomic structure, periodic table & and periodic properties of elements, different theories related to acid-base, HSAB principle, general organic chemistry, and concept of chirality, stereochemistry, some important nucleophilic substitution and elimination reaction including mechanism. They can also gain some practical experience in Dichromatometry titration, Permanganometry titration, Iodometry titration, and estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.

#### **CHEM-H-CC1-1-Th or CHEM-H-CC1-3-Th and CHEM-H-SEC1-1-Th**

Students learn about theoretical knowledge of atomic structure, periodic table & and periodic properties of elements, and chemical bonding including VBT and MO theory, electronic displacements, physical properties of common organic compounds, concept of chirality, stereochemistry, chemical thermodynamics, thermochemistry and kinetics of different types of chemical reactions. Quantitative analysis and its interdisciplinary nature, different types of titrimetric analysis like Acid-base titrimetry, Redox titrimetry, Precipitation titrimetry, Complexometric titrimetry, Gravimetric Analysis, and Numerical problems wherever applicable. They can also gain some practical experience in the Preparation of primary standard solutions, Standardization of secondary standard solutions, Dichromatometry titration, and Permanganometry titration.

#### **CC2/GE2**

Students learn about theoretical knowledge of chemical thermodynamics, thermochemistry, chemical equilibrium, ideal and non-ideal solutions and their laws, phase equilibrium, and phase diagram, solid states, the concept of crystallography, error analysis, and computer applications, Preparations and reactions of aliphatic hydrocarbons like alkanes, alkenes, and alkynes, Redox reactions, and Nernst equation, the feasibility of a redox titration, redox potential at the equivalence point, and redox indicators. They can also gain some practical experience in the study of the kinetics of acid-catalyzed hydrolysis of ester, the kinetics of decomposition of H<sub>2</sub>O<sub>2</sub> (Clock Reaction), the viscosity of unknown liquid (glycerol, sugar) with respect to water, determination of solubility of sparingly soluble salt in water, in electrolyte with common ions and neutral electrolyte (using common indicator), preparation of buffer solutions and find the pH of an unknown buffer solution, determination of surface tension of a liquid using Stalagmometer.

#### **CC3/GE3**

Students learn about theoretical knowledge of ionic bonding, and chemical bonding including VBT and MO theory, comparative study of p-block elements (group 13-17), 3d series transition

elements, lanthanoids and actinoids, co-ordination Chemistry, ionic Equilibrium (acid-base theory), conductance, electrochemical cells, preparation and reaction of some Aromatic Hydrocarbons, aryl halides and organometallic compounds - Grignard reagents. They can also gain some practical experience in the study of qualitative semi-micro analysis of mixtures containing two radicals where emphasis should be given to the understanding of the chemistry of different reactions.

#### **CC4/GE4**

Students learn about theoretical knowledge of preparation and reaction of Alcohols, Phenols and Ethers, Carbonyl Compounds (Aldehydes and Ketones), some common name reactions with mechanisms, study of Carboxylic Acids and Their Derivatives, different mechanisms of ester hydrolysis, reaction of amines and diazonium Salts, amino acids and carbohydrates chemistry, Crystal Field Theory, Quantum Chemistry & different type of physical Spectroscopy. They can also gain some practical experience in the study of qualitative analysis of single solid organic compound(s) containing special elements (N, Cl, and S), functional groups: Aromatic-NO<sub>2</sub>, Aromatic -NH<sub>2</sub>, -COOH, carbonyl (no distinction of -CHO and >C=O needed), -OH (phenolic), and identification of pure organic compounds.

#### **DSE (A)**

Students learn about theoretical knowledge of synthesis and modification of inorganic solids and their technological importance, nanomaterials, introduction to engineering materials for mechanical construction, composite materials, specialty polymers, Glass, Ceramics, Cements, Different types of fertilizers, surface coatings, primary and secondary batteries, alloys, General principles and properties of different catalysts, and explosive properties in organic compounds. They can also gain some practical experience in the determination of cation exchange method, determination of total difference of solids, synthesis of the hydrogel by co-precipitation method, synthesis of silver and gold metal nanoparticle, determination of free acidity in ammonium sulphate fertilizer, estimation of Calcium in Calcium ammonium nitrate fertilizer, estimation of phosphoric acid in superphosphate fertilizer, electroless metallic coatings on ceramic and plastic material, determination of the composition of dolomite (by complexometric titration), analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples, analysis of Cement, and preparation of pigment (zinc oxide).

#### **DSE (B)**

Students learn about theoretical knowledge of introduction to Green Chemistry, principles of Green Chemistry and designing a chemical synthesis, examples of Green Synthesis/ Reactions and some real-world cases, future trends in Green Chemistry, alkaloids and their reaction, terpenes, optical methods of analysis including UV-Visible Spectrometry, Infrared Spectrometry, Flame Atomic Absorption, and Emission Spectrometry, estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers, thermal methods of analysis, different separation techniques like solvent extraction, mechanism of extraction, qualitative and quantitative aspects of solvent extraction, chromatography, IC, GLC, GPC, TLC and HPLC, Stereoisomeric separation and analysis, and role of computers in instrumental methods of analysis.

They can also gain some practical experience in the acetylation of primary amine (preparation of acetanilide), [4+2] Cycloaddition reaction (Diels-Alder reaction between furan and maleic anhydride), preparation of biodiesel from vegetable/waste cooking oil, photoreduction of benzophenone to benzopinacol in the presence of sunlight, Pinacol-pinacolone rearrangement reaction (preparation of benzopinacolone), solid state synthesis of benzoic acid from benzyl, Benzoin condensation using thiamine hydrochloride as a catalyst instead of potassium cyanide, green multicomponent synthesis (three component coupling), base catalysed aldol condensation (synthesis of dibenzal propanone from benzaldehyde and acetone), bromination of *trans*-stilbene using bromide/bromate mixture, preparation and characterization of gold nanoparticles using tea leaves, green radical coupling reaction, separation techniques by Chromatography, solvent extractions, analysis of soil, ion exchange methods, and Spectrophotometry.

### **SEC (A)**

Students learn about theoretical knowledge of basic Analytical Chemistry including analysis of soil, analysis of water, analysis of food products, different types of chromatography, Ion-exchange chromatography, analysis of cosmetics-Major and minor constituents and their function, suggested Instrumental demonstrations including Estimation of macronutrients, spectrophotometric determination of Iron in Vitamin / Dietary Tablets, spectrophotometric identification and determination of caffeine and benzoic acid in soft drink, analytical clinical biochemistry including carbohydrates, proteins, enzymes, lipids, lipoproteins, and a diagnostic approach by blood/ urine analysis.

### **SEC (B)**

Students learn about theoretical knowledge of drug discovery, design and development, basic retrosynthetic approach, synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, Ibuprofen); antibiotics (Chloramphenicol)antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), central nervous system agents (Phenobarbital, Diazepam),cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine), aerobic and anaerobic fermentation, production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C, general introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, structure activity relationship, synthesis and technical manufacture and uses of different classes of pesticides.