

Programme Outcome of FYUG Course

(From Academic Year: 2023-2024)

Course outcome of all papers:

- Structure of atoms, chemical bonding, nanomaterials, chemical equilibrium, thermodynamics, kinetics, electrochemistry, spectroscopy, coordination compounds, photochemistry, stereochemistry, important organic reactions, Indian chemistry through ages, contribution of Indian scientists towards chemistry, separation techniques etc.
- Understand the evolving state of knowledge in a rapidly developing field.
- Conduct different types of important chemical analysis.
- Apply the knowledge of chemistry in relevant fields.

FYUG 1st Semester

CHM-DSC-101 (Inorganic Chemistry-I): Atomic Structure, Chemical Bonding and Metallurgy

On completion of the course, students are able to understand

- Describe Bohr's theory, de Broglie equation, Heisenberg's Uncertainty Principle, Schrödinger's wave equation, Quantum numbers, wave functions, atomic orbitals, rules for filling up atomic orbitals,
- Periodic properties,
- Chemical bonds,
- Redox equations, Standard Electrode Potential, volumetric analysis,
- General Principles of Metallurgy.

CHM-DSC-102 (Physical Chemistry-I) : States of Matter and Solution

On completion of the course, students are able to understand

- Kinetic Theory of Gases, Vander Waals equation of state for real gases, Most probable, average and root mean square velocities, Collision number, mean free path of molecules, law of corresponding states, liquefaction of gas, inversion temperature,
- Physical properties of liquids; vapors pressure, surface tension and coefficient of viscosity, Interfacial tension, cleansing action of detergents,

- Types of crystal, lattice, unit cell, seven crystal systems, Miller indices, X-ray diffraction, Bragg's law, Defects in crystals, Colour center, Energy band theory of Conductor, Semiconductors and insulators,
- Glasses, liquid crystal, ideal solutions, Raoult's law, vapour pressure, Distillation of solutions, Azeotropes, Nernst distribution, solvent extraction.

CHM-DSM-101 (Fundamentals of Chemistry -I)

On completion of the course, students are able to understand

- Bohr's theory, Dual nature of electron, hydrogen atom spectra, quantum numbers, Rules for filling electrons in various orbitals, electronic configurations, Chemical bonding: valence bond theory, VSEPR theory, molecular orbital theory,
- Kinetic Theory of Gases: Postulates of Kinetic Theory of Gases Deviation of real gases from ideal behavior, Vander Waals equation of state for real gases, Most probable, average and root mean square velocities, Collision number, mean free path of molecules, surface tension, viscosity,
- Types of solids, unit cell, defects in crystals,
- Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation, Cleavage of Bonds, Nucleophiles and electrophiles, Reactive Intermediates, Strength of organic acids and bases, Aromaticity, Benzenoids and Hückel's rule.

CHM-SEC-101 (Separation Techniques)

On completion of the course, students are able to understand and apply

- Solvent extraction, Chromatographic Techniques, Measurement of optical rotation, calculation of Enantiomeric excess (ee)/ diastereomeric excess (de) ratios and determination of enantiomeric composition, Chiral solvents, Chiral chromatographic techniques using chiral columns, Ion exchange Chromatography, Techniques involved in separation and purification of components of binary solid mixture.

CHM-IDC-101 (Fundamentals of Chemistry -I): (Application of Chemistry in Everyday life)

On completion of the course, students are able to understand

- Vitamins, minerals and enzymes, Respiration, Respiratory enzymes, oxygen transport mechanism in body, oxygen transport proteins, Respiration in lower animals, Energy production in body, ATP, mechanism of food digestion, Human digestive system,

- Basic concept on food, nutrition and nutrients, food preservation, Food Standards, Food additives, adulterants and contaminants, food colorants,
- Soaps and Detergents,
- Biofuels,
- Fibers: natural fibers, cotton, wool, silk, rayon, artificial fibers, polyamides, acrylic acid, PVC, biodegradable polymers.

FYUG 2nd Semester

CHM-DSC-151 (Organic Chemistry-I) : Introductory Organic Chemistry

On completion of the course, students are able to understand

- Classification, Nomenclature, Hybridization, Shapes of molecules, Inductive, electromeric, resonance, mesomeric effects, hyperconjugation, Dipole moment;
- Organic acids and bases, Homolytic and Heterolytic fission, Curly arrow rules, formal charges, Electrophiles and Nucleophiles, Carbocations, Carbanions, Free radicals, Carbenes, reactions of aliphatic, aromatic and polynuclear hydrocarbons, Stereochemistry and Conformation analysis, Optical Isomerism, carbohydrates.

CHM-DSC-152 (Practical) : Inorganic, Organic and Physical Chemistry

On completion of the course, students are able to understand and get hands on knowledge on

- Preparation of Chrome alum, Tetraamminecopper(II) sulphate, Sodium Trioxalatochromate (III), Preparation of Aluminium potassium sulphate, Potash alum, Preparation of Manganese (III) phosphate,
- Calibration of glass ware, pipette, burette and volumetric flask,
- Preparation of solutions of different Molarity / Normality,
- Preparation of derivative of organic compound containing monofunctional group,
- Determination of the surface tension, viscosity, transition temperature, solubility of salt in water, refractive index of liquid.

CHM-DSM-151 : Fundamentals of Chemistry -I

On completion of the course, students are able to understand

- Bohr's theory, Dual nature of electron, hydrogen atom spectra, quantum numbers, Rules for filling electrons in various orbitals, electronic configurations, Chemical bonding: valence bond theory, VSEPR theory, molecular orbital theory,
- Kinetic Theory of Gases: Postulates of Kinetic Theory of Gases Deviation of real gases from ideal behavior, Vander Waals equation of state for real gases, Most probable, average and root mean square velocities, Collision number, mean free path of molecules,
- Surface tension, viscosity,
- Types of solids, unit cell, defects in crystals,
- Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation, Cleavage of Bonds,
- Nucleophiles and electrophiles, Reactive Intermediates, Strength of organic acids and bases, Aromaticity, Benzenoids and Hückel's rule.

CHM-SEC-151 (Basic Analytical Chemistry)

On completion of the course, students are able to understand

- Concept of sampling, accuracy, precision, error in analytical measurements,
- Significant figures,
- Chromatography,
- Analysis of soil, pH,
- Complexometric titrations, chelation, indicators,
- Analysis of water, purification method,
- Analysis of cosmetics,
- Nutritional value of foods, food preservations and adulteration.

CHM-IDC-151 : Indian Chemistry through the Ages

On completion of the course, students are able to understand

- Matter, elements, atoms, and molecules, metal and non-metals, The structure of the atom, chemical bonding, melting and boiling points, Scientific Notation,
- Acid rain, Greenhouse effect, global warming,
- Alchemy, Rasasastra, General layout of the laboratory and apparatus used in ancient chemistry, the Chemical Arts and Crafts in Historic period like glass making, Soap, Dyeing, Cosmetics and Perfumes, Ink, Metallurgy in ancient India,
- Contributions of Sir Acharya Prafulla Chandra Ray, Professor Har Govind Khorana, Prof C N R Rao, Dr. Shanti Swarup Bhatnagar, Dr. Asima Chatterjee, Nobel laureate Venkatraman

Ramakrishnan, Dr. Kamala Sohonie, Dr.Yellapragada Subba Rao, Dr. Darshan Ranganathan to chemistry.

FYUG 3rd Semester

CHM-DSC-201 (Inorganic Chemistry -II) : s-, p-block Elements, Coordination Chemistry and its Application

On completion of the course, students are able to understand

- Chemistry of s, p, d and f –block elements and noble gases,
- Concepts of acids and bases,
- Inorganic polymers,
- Coordination theories, nomenclature, geometry of coordination complexes,
- Metal ions present in biological systems and their importance, Toxicity of metal ions, use of chelating agents in medicine.

CHM-DSC-202 (Organic Chemistry -II) : Functional Group Chemistry

On completion of the course, students are able to understand

- Preparation and properties of alkyl halides, Alcohols, phenols, ethers, Carbonyl Compounds, Carboxylic acid and their derivative, Sulphur & Nitrogen containing functional groups.

CHM-DSM-201 (Fundamentals of Chemistry -II)

On completion of the course, students are able to understand

- General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the groups of groups 13 and 14,
- General principles of chemical thermodynamics,
- Ideal and non ideal solutions, Azeotropes, phases, phase equilibrium,
- Preparation and reactions of hydrocarbons and alkyl halides.

CHM-SEC-201 : Forensic Chemistry

On completion of the course, students are able to understand

- Forensic applications of chromatography, Ultraviolet-visible spectroscopy, infrared spectroscopy, Colorimetric analysis and Lambert-Beer law, Development and detection of Fingerprints,

- Significance of toxicological findings, techniques used in toxicology, toxicological analysis, Narcotics, Drugs and Psychotropic Substances,
- Chemistry of fire, collection and preservation of arson evidence, analysis of fire debris. Analysis of ignitable liquid residue, scientific investigation and evaluation of clue materials, information from smoke staining,
- Chemistry of explosives, blast waves, searching the scene of explosion, post blast residue collection and analysis.

CHM-IDC-201 : Heritage of Indian Metallurgy

On completion of the course, students are able to understand

- Ore and minerals, metallurgy in Indian social context, Importance of metals in human civilization, early evidence of metal in the Indian subcontinent, Alloy, Metallurgy before and during the Harappan Civilization, origin of metallic currency in Indian subcontinent, History of Iron Age in Ganges civilization, process of iron-smelting,
- Indian definition, production technique and applications of Wootz steel, Role of carbon in steel, wrought iron, mechanism of Rust-resistance of the Iron Pillars in Delhi, Dhar and Kodachadri Hill.

FYUG 4th Semester

CHM-DSC-251 (Physical Chemistry -II) : Chemical Thermodynamics & Equilibrium

On completion of the course, students are able to understand

- Intensive and extensive variables, state and path functions; exact differentials, laws of thermodynamics, phase rule, degrees of freedom, activity and fugacity, phase diagram, Partial molar quantities, Chemical potential-its physical significance, Gibbs-Duhem equation, change in thermodynamic functions in mixing of ideal gases, thermodynamic equilibrium, Le Chatelier's Principle, Van't Hoff's Isotherm, Coupling of exoergic and endoergic reactions,
- Electrolytes, degree of ionization, ionic product of water, pH scale, common ion effect, Salt hydrolysis, Buffer solutions, calculation of pH from acid – base titration curves.

CHM-DSC-252 (Inorganic Chemistry -III) : Organometallic and Analytical Chemistry

On completion of the course, students are able to understand

- Classification of organometallic compounds, hapticity of organic ligands, Metal carbonyls, Ferrocene: Structure and aromaticity, Metal Alkyls, Ziegler – Natta Catalyst, Grignard reagent, inorganic reaction mechanisms, Thermodynamic and Kinetic stability, Alkene hydrogenation

(Wilkinsons Catalyst) Hydroformylation, Synthetic gasoline (Fischer Tropsch reaction), Synthesis gas by metal carbonyl complexes,

- Analysis of cations and anions and solubility products, common ion effect.

CHM-DSC-253 (Practical) : Inorganic, Organic and Physical Chemistry

On completion of the course, students are able to understand and get hands on knowledge on

- Volumetric Titration,
- Organic preparation and reactions,
- Purification of organic compounds,
- Determination of solubility and ΔH of the dissolution process,
- Preparation of buffer solution, pH-metric titration, Determination of Critical Solution Temperature.

CHM-DSM-251 (Practical) : Inorganic, Organic and Physical Chemistry

On completion of the course, students are able to understand and get hands on knowledge on

- Qualitative analysis of inorganic mixtures,
- Qualitative analysis of organic compounds,
- Organic preparation, purification of organic compounds,
- Determination of solubility and ΔH of the dissolution process,
- Preparation of buffer solution, pH-metric titration, conductometric titration,
- Determination of viscosity and surface tension.

CHM-DSM-252 : Fundamentals of Chemistry -II

On completion of the course, students are able to understand

- p block elements of Group-13 & Group-14,
- Laws of thermodynamics, Review of thermodynamics and the Laws of Thermodynamics, standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution,
- Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, Variation of enthalpy of a reaction with temperature– Kirchhoff's equation, Ideal and non ideal solution, Distillation of solutions, Azeotropes, Phases, degrees of freedom of a system, phase equilibrium, Phase Rule, Phase diagrams of one-component systems,
- Preparation and properties of alkanes, alkenes, alkynes, alkyl and aryl halides.

FYUG 5th Semester

CHM-DSC-301 : Quantum and Photochemistry

On completion of the course, students are able to understand

- Black-body radiation, wave particle duality, wave functions,
- Quantum mechanical approach to chemical bonding,
- Photochemical processes.

CHM-DSC-302 : (Organic Chemistry -III) : Heterocyclic, Biochemistry, Natural products & Photochemistry

On completion of the course, students are able to understand

- Heterocyclic compounds, Amino acids, peptides, proteins, Enzyme, lipid, nucleic acids Alkaloids, terpenes and photochemistry of organic compounds.

CHM-DSC-303 (Practical) : Inorganic, Organic and Physical Chemistry

On completion of the course, students are able to understand and get hands on knowledge on

- Iodometric, Iodimetric and Gravimetric, pH metric and conductometric titration,
- Qualitative organic analysis,
- Verification of Lambert-Beer's law,
- Study of reaction kinetics.

CHM-DSM-301 : Fundamental of Chemistry-III

On completion of the course, students are able to understand

- 3d and f- block elements,
- Rate of reaction, order of reaction,
- Chemical equilibrium, ionic equilibrium,
- Preparation methods and properties of alcohols, phenols, aldehydes, ketones and carboxylic acids.

CHM-DSM-302 : Fundamental of Chemistry-III

On completion of the course, students are able to understand

- 3d and f- block elements,
- Rate of reaction, order of reaction, chemical equilibrium, ionic equilibrium,

- Preparation methods and properties of alcohols, phenols, aldehydes, ketones and carboxylic acids.

FYUG 6th Semester

CHM-DSC-351 : Advance Materials

On completion of the course, students are able to understand

- Nano particle, quantum dots, nanowires, ultrathin films, multilayered materials, metal oxides, semiconductors, carbon nanotube, graphene, applications of nanomaterials, composite materials,
- Liquid crystals, surfactants,
- Polymerization reactions, polymers.

CHM-DSC-352 : Spectroscopy

On completion of the course, students are able to understand different types of spectroscopic techniques.

CHM-DSC-353 (Physical Chemistry –III) : Chemical Kinetics and Electrochemistry

On completion of the course, students are able to understand

- Rate, order and molecularity of a reaction, collision theory, kinetics of different reactions,
- Electrolytic dissociation, Conductivity, Conductometric titration, Ostwald's dilution Law, hydrolysis constants of salts, electrolysis, electrochemical cell.

CHM-DSC-354 (Practical) : Inorganic, Organic and Physical Chemistry

On completion of the course, students are able to understand and get hands on knowledge on

- Qualitative inorganic analysis, chromatographic separation,
- Determination of rate constant of hydrolysis reaction, saponification reaction,
- Conductometric titration, determination of equivalent conductance, potentiometric titration.

CHM-DSM-351 (Practical) : Inorganic, Organic and Physical Chemistry

On completion of the course, students are able to understand and get hands on knowledge on

- Qualitative analysis of inorganic mixtures, qualitative analysis of organic compounds,
- Organic preparation, purification of organic compounds,
- Determination of solubility and ΔH of the dissolution process,

- Preparation of buffer solution,
- pH-metric titration, conductometric titration,
- Determination of viscosity and surface tension.