DEPARTMENT OF CHEMISTRY

VISION

Aspiration to be a leading force for advancing society through the continuous pursuit of educational excellence, cutting-edge teaching in chemistry and inculcation of values.

MISSION

1. To develop and implement student centric teaching learning methods for basic fundamental aspects of Chemistry through UG programme.

2. To produce fundamentally and conceptually strong academicians and research oriented chemists who will constructively contribute to the overall growth of the society.

3. To usher in construction of the thinking of students to scientifically tackle modern problems and challenges in modern chemistry.

PROGRAMME OUTCOME

On completion of the programme, the students will be able to disseminate and demonstrate the knowledge of the concepts in the concerned discipline.

1. **Social Relevance**: The programme helps to expand scientific temper and can prove to be more beneficial for the society as the scientific developments can make a nation or society to grow at a rapid pace.
2. **Critical thinking**: Identify and analyse current issues and trends in higher education and come-up with intellectual, organizational, and personal ideas and decisions from different perspectives.
3. **Effective learning**: Transform and empower women graduates to meet global challenges through holistic education in terms of recent Teaching-Learning methodologies.
4. **Communication Skills**: Ability to express thoughts and ideas effectively in writing and orally; communicate with others using the professional standards of their fields; confidently share one's views and express herself.
5. **Social Interaction**: Heighten the conscious of the graduates on socio-economic concern and to evolve it as an in built mechanism to chisel as better human being.
6. **Environment and sustainability**: Understand the issues of environmental contexts and demonstrate the knowledge for sustainable development.

7. **Ethics**: Express legal and ethical issues and understand the moral dimensions of decisions and responsibilities.

8. **Information and Digital Literacy**: Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.

9. **Life-long learning**: Gain ability to engage in independent and life-long learning with socio-technological changes.

10. **Higher Studies & Research** –related skills: A sense of inquiry and capability for asking relevant/ appropriate questions, problematizing, synthesizing and articulating; Provide an intellectually stimulating environment to develop skills and enthusiasm of students to the best of their potential in the higher studies.

PROGRAMME SPECIFIC OUTCOME

After successful completion of three-year degree program in Chemistry a student should be able to:

PSO1: Understand and analyse the fundamental concepts, principles and processes underlying the academic field of chemistry, its different subfields (analytical, inorganic, organic and physical, green, polymer etc.) and its linkages with related disciplinary areas/subjects.

PSO2: Demonstrate the procedural knowledge that creates different types of professionals in the field of chemistry and related fields such as pharmaceuticals, chemical industry, teaching, research, environmental monitoring, product quality, consumer goods industry, food products, cosmetics industry etc.

PSO3: Employ critical thinking and the scientific method to design, carry out, record and analyse the results of chemical experiments and get an awareness of the impact of chemistry on the environment and the society.

PSO4: Use chemical techniques relevant to academia and industry, generic skills and global competencies, including knowledge and skills that enable students to undertake further studies in the field of chemistry or a related field and work in the chemical and non-chemical industry sectors.

PSO5: Understand safety of chemicals, transfer and measurement of chemicals, preparation of solution and find out the green route for chemical reaction for sustainable development.

CORE COURSE – I

INORGANIC CHEMISTRY- I

COURSE OUTCOME

At the end of the course, the students will be able to:

CO1: Understand different models of atoms, quantum approach to wave function, different shapes of s,p,d,f orbitas & the principles related to stability of atoms.

CO2: Get general idea about the periodic table & s,p,d,f block elements and their general trends of properties.

CO2: Differentiate types of bonding and application of valance bond theory and molecular orbital theory.

CO4: Attain the idea about shape and geometry of molecules using VSEPR theory, to gain knowledge about Fajan's rule & metallic bond, redox reactions, principle involved volumetric analysis (Fe,Cu).

LAB: Have practical knowledge about acid base titration & oxidation reduction titration

CORE COURSE – II

PHYSICAL CHEMISTRY- I

COURSE OUTCOME

At the end of the course, the students will be able to:

CO1: Get idea about kinetic gas equation & collision parameters,Maxwell distribution of velocities & degree of freedom , gain knowledge on real & ideal gases , their equation and their isotherms .

CO2: Able to know the qualitative approach of the liquid state and it's physical properties.Effect of temperature and addition of solute on viscosity and surface tension, cleasing action of detergents.

Get about the idea of different types of electrolytes and ionization constant of weak electrolytes,pH scale and common ion effect.

CO3: Crystal system and Bravis lattice ,Miller indices, symmetric operation, different methods of XRD. Structure of analysis of different unit shell and different defects in crystals.

CO4: To get the knowledge about salt Hydrolysis, Buffer action and Henderson's euation, solubility principle.

LAB: Qualitative treatment of ACID-BASE titration curve.

CORE COURSE – III

ORGANIC CHEMISTRY- 1

At the end of the course, the students will be able to:

CO1: To know about different physical effect of molecule and its application and Relative strength of ACID-BASE.

Type, shape,stability of different reactive intermediates,different Oranic reactions and their mechanisms. Preparation of Alkane and their reactivity with Halogens.

CO2: Different types of projection formula, Geometrical, Optical Isomerism and it's Notation. Concept of chirality.

CO3: Preparation of Alkenes and Alakynes and their reaction mechanism. Concept about cyclo-Alkane, their relative stability of their conformation using Energy diagram.

CO4: Concept of Aromaticity, Electrophylic- Aromatic substitution. Directing effect of groups of Aromatic Hydrocarbons.

LAB: Able to analyze functional groups of different organic compounds, diffrent separation and purification method.

CORE COURSE – IV

PHYSICAL CHEMISTRY-2

At the end of the course, the students will be able to:

CO1: Concept of thermodynamics and zeoth, 1^{st} law. Thermos chemistry and it's application.

CO2: Concept of 2^{nd} interpretation of entropy of reversible and irreversible rection. Concept of 3^{rd} law , free energy functions and their relations.

CO3: Partial molar quantities, dependence of thermodynamics parameters on composition and Free energy of mixing concepts, understand the concept of equilibrium and various equilibrium constant, vantoff reaction, Factors of equilibrium, Leichatlier's Principle.

CO4: Get knowledge on vapour pressure, Roult's Law, Henery's Law and the concepts of different Colligative Properties.

LAB: Able to determine heat capacity of calorimeter and enthalpy of ionization.

CORE COURSE – V

INORGANIC CHEMISTRY-2

At the end of the course, the students will be able to:

CO1: To understand basic principle of metallurgy Ellingham diagram, different methods of purification**,** concepts related to acid base and HSAB principle.

CO2: Can gain idea about inert pair effect, Diagonal relationship and complex formation tendency & p-block elements.

CO3: Understand the concept of bonding, preparation, properties, uses and different p-block elements.

CO4: Preparation and properties of Xenon compounds and predict the structure on the basis of VBT & VSEPR theory.

Synthesis, structure & application of silicones, borazine, phosphagenes.

LAB: Have practical knowledge on iodometric titration and can prepare inorganic compounds Cu_2O,Cu_2Cl_2, Potash alum.

CORE COURSE – VI

ORGANIC CHEMISTRY-2

At the end of the course, the students will be able to:

CO1: Can attain knowledge on preparation & properties of alkyl and aryl hallides, different nucleophilic substitution reactions, gain brief knowledge on organometallic compounds of Mg & Li.

CO2: Preparation & properties of alcohols, epoxides, ethers, phenols and Name Reactions-Reimer Teiman, Pinacol-Pinacolon Rearrangement, Claisen Rearrangement.

CO3: Structure, reactivity and preparation of carboxyl compounds and some important name reactions involving carbonyl compounds.

CO4: Preparation, properties & reactions of carboxylic acids and their derivatives, thiols & thio ethers.

LAB: Preparation of organic compounds & their respective derivatives.

CORE COURSE – VII

PHYSICAL CHEMISTRY-3

At the end of the course, the students will be able to:

CO1: To have knowledge on concept of phase, components & degrees of freedom, derive Claussius Clapeyron equation, phase diagram of congruent & incongruent system.

CO2: Concept on three component system, azeotropes, CST, derive Gibb's Duhem equation & Nernst distribution law & its application.

CO3: Derive differential & integrated rate equation upto 2^{nd} order, Kinetics ofcomplex reaction, application of Collision theory.

CO4: Understand mechanism of catalysed reactions, different types of catalysis, derive adsorption isotherm equation (Langmuir, Freundlich & Gibb's isotherm)

LAB:

CORE COURSE – VIII

INORGANIC CHEMISTRY-III

At the end of the course, the students will be able to:

CO1: Able to understand Werner's theory, Nomenclature, Isomerism & Stereo Chemistry of Coordination Chemistry.

Get the concept of VBT,CFT, Ligand Field Theory & Jahn-Teller Distortion.

CO2: Get the idea of electronic configuration, colour, valency,magnetic property and complex formation property of transition element and Latimer & Bisworth Diagram.

CO3: Understand the Chemistry of Ti, V, Cr, Mn, Fe, Co & various properties of Lanthanides and Actinides.

CO4: Understand the importance of metal in biological system, toxicity, deficiency & use of metal in medicine.

LAB: Get practical knowledge on preparation of inorganic complexes and complexometric Gravimetric Analysis.

CORE COURSE –IX

ORGANIC CHEMISTRY-III

At the end of the course, the students will be able to:

CO1: Understand the preparation & important reactions of nitro and nitrile compounds, preparation and properties of amines and important name reactions.

CO2: Preparation and synthetic application of Benzene Diazonium salt, Preparation and structure elucidation of Napthalene and Anthracene.

CO3: Understand the structure, reaction mechanism of Furan, Pyrrole, Thiophene, Pyridine, Pyrimidine etc.

CO4: Understand Structure elucidation & synthesis of Hygrine, Nicotine, Niral, Citral and medicinal importance of some alkaloids.

LAB: Have a practical knowledge on quantitative organic analysis of organic compounds (CHN System).

CORE COURSE –X

PHYSICAL CHEMISTRY-IV

At the end of the course, the students will be able to:

CO1: To accommodate the knowledge about the relationship between Conductance & Conductivity of Weak-Strong Electrolytes &their different laws.

CO2: To find the mobilities to their relation with transference no, different applications of conductance measurement like solubility product & titrations etc.

CO3: To know the aspects of Faraday's law of Electrolysis, rules in Industrial applications. The introductory idea about cells, different parameters like EMF, pH & Equilibrium measurements.

CO4: The quantitative idea of potentiometric titration, concentration of cells with transference.

To get the basic idea about electrical properties like polarisability and their measurement of atoms & molecules.

LAB:

CORE COURSE –XI

ORGANIC CHEMISTRY-IV

At the end of the course, the students will be able to:

CO1: To get knowledge on principle & different electronic transitions, Lambert-Beer's law, chromophores & auxochromes, application of woodward rules for ƛm calculation.

CO2: Able to attain the principle of molecular vibrations, application of IR in simple functional group analysis, factors affecting IR absorption.

CO3: Understand the principle of proton magnetic resonance, anisotropic effect, fragmentation & instrumentation of mass spectroscopy. Applications of IR, UV & NMR for identifying simple organic molecule.

CO4: Understand the classification & importance of carbohydrates, conformational structure & interconversions of monosaccharide.

LAB:

CORE COURSE –XII

PHYSICAL CHEMISTRY-V

At the end of the course, the students will be able to:

CO1: Understand the postulates of Quantum mechanics, Schrodinger's equation and its application to particle in 1D box, simple harmonic motion and Rigid rotator.

CO2: Get an idea about different type of bonding LCAO-MO treatment of H_2. Comparison of LCAO-MO & VB treatment of H_2. MOT of triatomic molecule.

CO3: To attain the idea of interaction of electromagnetic radiation and understand the principle, selection rule & application of Rotational & vibrational spectroscopy.

CO4: Idea about Raman spectroscopy & electronic spectroscopy and the laws of photochemistry and quantum yield.

LAB: Have practical knowledge of calorimeter and spectroscopic titrations.

CORE COURSE – XIII

INORGANIC CHEMISTRY- IV

At the end of the course, the students will be able to:

CO1: Understand the organometallic compounds and the nature of bonding in them, apply 18-electron rule to rationalize the stability of metal carbonyls and related species, π-acceptor behaviour of CO, synergic effect and use of IR data to explain extent of back bonding.

CO2: Have an introduction to metallocene (ferrocene), its structure and understanding on its aromatic property and also to Zeigler-Natta catalyst.

CO3: Get a general idea of catalysis and describe in detail the mechanism of Wilkinson's catalyst, Wackers process and synthetic gasoline manufactured by Fischer-Tropsch process. Understand and explain the basic principles of qualitative inorganic analysis.

CO4: Have glimpses of inorganic reaction mechanisms, trans effect and substitution reactions on square planar and octahedral complexes.

LAB: Have practical knowledge on qualitative analyses of mixtures containing multiple cations and anions.

CORE COURSE – XIV

ORGANIC CHEMISTRY- V

At the end of the course, the students will be able to:

CO1: Understand the classification, synthesis, properties and reactions of Amino acids, Zwitter ion and isoelectronic point.

Have glimpses of classification, synthesis and end group analysis of peptides, Structure of proteins, renaturation and denaturation of prolein.

CO2: Understand the classification, mechanism of ezyme actions, enzyme's specificity and the phenomenon of inhibition.Get idea about components of Nucleic acids,

CO3: Understand the concepts of structure and properties of Lipids and the concept of energy in Bio system

CO4: Know classification, Structure, Synthesis and Uses of various pharmaceutical compounds and the chemistry of dyes, their classification and preparations.

LAB: Have practical knowledge on preparation on aspirin and methyl orange, saponifiction and estimation of different compounds.

DSE-I

POLYMER CHEMISTRY

At the end of the course, the students will be able to:

CO1: The introductory idea aboput types of polymers forces and their polymerization process. The general things about the functionality and degree of polymerization.

CO2: Understand the application of polymerization, mechanism and kinetics of ionic, step growth and co-ordination polymers, crystallization and crystallinity.

CO3: Calculate molecular weight of polymers and significance of polydispersity index, concept of Glass transition temperature and WLF equation.

CO4: Get about the idea of the different properties of commercialised polymers,Nylon,Bakelite and different aspects about Bio degradable polymers.

LAB: Prepare and characterise different polymers.

DSE-II

GREEN CHEMISTRY

At the end of the course, the students will be able to:

CO1: Have a glimpse of green chemistry and explanation of green chemistry principle 1-5.

CO2: Understand the principles of green chemistry 6-12, green analytical techniques.

CO3: Synthesize different compounds by green procedure, have knowledge on the concept & reactions involving microwave and ultrasound.

CO4: Application of green chemistry as a surfactant, antifoulant, cradle to cradle, biofuel.

LAB: Will able to apply green chemistry methods in different reactions.

DSE-III

INDUSTRIAL CHEMICAL AND ENVIRONMENT

At the end of the course, the students will be able to:

CO1: Access the idea of manufacture, storage, application, handling of various industrial gases & chemical

CO2: Understand biogeochemical cycles, causes effect and control of air pollution.

CO3: Have glimpses of water pollution different purification methods & industrial waste management methods.

CO4: Different sources of energy, nuclear pollution, their management & biocatalyst.

LAB: Practical knowledge on pollution measurement techniques.

DSE-IV

INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE CO2

At the end of the course, the students will be able to:

CO1: Understand the types, classification properties of glass ceramics, cements.

CO2: Get an idea about types & manufacture of fertilizers how glimpses of concept of battery & cell.

CO3: How idea about classification of surface coating formulation composition and properties of paints and pigments.

CO4: How knowledge on concept of properties of Alloy manufacture, Composition manufacture of steel and the chemistry of explosive.

LAB: Have Practical knowledge on estimation of fertilizer, analyzation of Alloy cement & preparation of pigment.

GENERIC ELECTIVE (GE) PAPER – I

INORGANIC CHEMISTRY

At the end of the course, the students will be able to:

CO1: The general feature of Atomic structure according to Bohr's , de- Broglie's, Heisenberg Uncertainty principles & H – spectra.

The Quantum mechanics of Schrödinger equation, Wave function of 1s, 2s,2p,3s,3p & 3d orbitals.

CO2: The general idea about the Ionic bonding, solubility product relation with stability, lattice energy. The Born-lande equation, Born – Haber cycle & its application & Fajan theory.

CO3: To know about the physical effects & cleavage of Bonds in Organic chemistry. The structure, shape & Reactivity of Organic molecules, aromaticity accordingly Huckel's rule.

CO4: Get a knowledge on preparation and chemical reaction of Alkanes, Alkenes, and Alkynes.

LAB : Have a practical knowledge about volumetric analysis, detection of (N,S,Cl) elements in organic compounds, separation & identification methods.

GENERIC ELECTIVE (GE) PAPER – II

PHYSICAL CHEMISTRY & ORGANIC CHEMISTRY

At the end of the course, the students will be able to:

CO1: Get the idea about different laws of thermodynamics, principle of thermo chemistry, calculation of bond energies, bond dissociation energy & resonance energy.

CO2: Understand different types of electrolytes & their ionization, P^H scale, ionization of weak acid & bases, common ion effect & salt hydrolysis.

CO3: How glimpse of preparation, reaction of Aromatic hydrocarbon, alkyl & Aryl halides.

CO4: Attain the concept on preparation reaction of Alcohol, Phenol, Ether & Aldehyde (Aromatic & Aliphatic)

LAB : How an practical knowledge on different thermo chemistry parameter calculation, P^H measurements and preparation, recrystalisation, purification of organic compounds.