Koneru Lakshmaiah Education Foundation
(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)
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DEPARTMENT OF CHEMISTRY
PROGRAM: M. SC CHEMISTRY
ACADEMIC YEAR: 2025-2026

Course Code	Course Title	CO No	Description of the course Outcome
25CY5101	Symmetry & Molecular Spectroscopy	CO1	Apply the principles of symmetry operations and group theory to determine point groups, construct character tables, and analyze molecular vibrations relevant to IR and Raman spectroscopy.
		CO2	Apply the fundamental principles of spectroscopic techniques to interpret spectral data and determine structural information of molecules using UV, IR, NMR, and MS.
		CO3	Apply the principles of microwave, photoelectron, and ESR spectroscopy to analyze molecular structure, electronic configurations, and magnetic properties of simple molecules.
		CO4	Apply the principles of Raman, Mössbauer, X-ray diffraction, and laser spectroscopy to interpret spectral data and investigate structural, electronic, and magnetic properties of materials.
25CY5102	Chemical Bonding & Coordination chemistry	CO1	Apply bonding models to determine molecular shapes and geometries of simple molecules.
		CO2	Use chemical concepts to explain the structure, bonding, and reactivity of boron cluster compounds.
		CO3	Apply bonding theories to describe the structure, reactivity, and uses of coordination complexes.
		CO4	Use spectral and magnetic data to explain the color and analytical properties of transition metal complexes.
		CO5	Analyze synthesis and characterization data to interpret the properties of inorganic compounds and evaluate results using scientific guidelines.

25CY5103	Structural Organic & Stereochemistry	CO1	Apply principles of aromaticity and reaction mechanisms to predict products and explain the selectivity and orientation in aromatic substitution reactions.
		CO2	Use knowledge of reactive intermediates and retrosynthetic analysis to design organic synthesis pathways and apply functional group transformations.
		CO3	Apply mechanistic and kinetic principles to interpret reaction outcomes and control factors like thermodynamic and kinetic stability.
		CO4	Use stereochemical concepts and conformational analysis to analyze chiral molecules and predict their behaviour in supramolecular and nano systems.
		CO5	Analyze the composition of a binary mixture and select appropriate synthetic routes for preparation of organic molecules.
25CY5104	Molecular thermodynamics & Chemical kinetics	CO1	Apply the laws and concepts of classical thermodynamics to solve problems in chemical systems.
		CO2	Use the properties of surfactants and macromolecules to explain their applications in chemical and biological systems.
		CO3	Apply rate laws and kinetic principles to interpret chemical reaction rates and mechanisms.
		CO4	Use concepts of photochemistry and luminescence to explain excited-state processes in chemical systems.
		CO5	Analyze experimental data and processes to develop practical skills for solving problems in industrial applications.
25CY5221	Concepts of Organic Synthesis	CO1	Apply modern synthetic methods and green chemistry principles to design and analyze environmentally friendly synthesis routes for pharmaceuticals and fine chemicals.
		CO2	Use reagents like enolates and protecting groups to plan and perform key reactions in organic synthesis with chemo- and stereoselectivity.
		CO3	Apply rearrangement and coupling reactions to develop synthetic strategies for building complex organic molecules.
		CO4	Use principles of pericyclic and photochemical reactions to predict products and design stereoselective synthetic pathways.

25CY5222	Food Analysis and Quality Assessment	CO1	Apply knowledge of food regulations, standards, and analytical methods to prepare samples and perform compositional analysis of foods.
		CO2	Use standard analytical techniques to determine the moisture, ash, fat, protein, and vitamin content in food samples.
		CO3	Apply chemical and biochemical methods to analyze food properties such as pH, fat characteristics, protein content, and contaminants.
		CO4	Use physical analysis methods like rheology, thermal analysis, and color measurement to evaluate the physical properties of food materials.
25IE5201	Essentials of Research Design	CO1	Illustrate Research objects, steps involved in research and articulate appropriate Research Questions
		CO2	Perform Literature Review in a Scholarly style and apply appropriate methods for Data collection
		CO3	Represent the data in tabular/Graphical form and prepare data for analysis
		CO4	Perform statistical modelling and analysis to optimize the data, prepare the data for publishing.
25CY5205	Reaction mechanism and organometallic Chemistry	CO1	Apply coordination chemistry principles to explain reaction mechanisms of coordination complexes.
		CO2	Apply thermodynamic concepts to explain complex formation and acid- base behaviour in aqueous solutions.
		CO3	Apply bonding models to describe the structure and bonding in d-block organometallic complexes.
		CO4	Use bonding concepts to illustrate metal cluster structures and categorize reaction types of d-block organometallic complexes.
		CO5	Analyze experimental data from the preparation and quantitative analysis to interpret and evaluate the properties of inorganic complexes.
25CY5206	Quantum, Surface & Electrochemistry	CO1	Apply quantum chemistry tools to study the structure and dynamics of molecules.
		CO2	Use adsorption principles to explain surface processes and their mechanisms.
		CO3	Apply electrochemical theories and models to solve problems related to redox systems and conductivity.

		CO4	Use statistical mechanics principles to calculate thermodynamic probabilities and predict particle distributions in chemical systems.
		CO5	Analyze experimental procedures and data to develop skills for solving industry-relevant chemical problems and improving process outcomes.
25CY5207	Biomolecules	CO1	Apply the classification and chemical properties of carbohydrates to predict their reactions and functions in biological and industrial processes.
		CO2	Use knowledge of amino acids and peptides to synthesize peptides and explain their metabolic pathways.
		CO3	Apply structural and chemical properties of nucleic acids to explain their functions and analyze their biological significance.
		CO4	Use the classification and reactions of lipids to analyze lipid metabolism and apply characterization of fats and oils.
		CO5	Apply the principles of chromatography, and qualitative analysis to isolate, separate and identify various biomolecules.
25CY61E5	Nano chemistry (Prof. Elective)	CO1	Apply the fundamental concepts of nanostructures, particle size, and confinement to analyze and explain size-dependent properties and biological interactions of nanomaterials.
		CO2	Use various top-down and bottom-up synthesis methods and characterization techniques to prepare and analyze nanomaterials for specific applications.
		CO3	Apply metal nanoparticles in catalytic reactions to design and evaluate catalytic processes for industrial and environmental applications.
		CO4	Use nanomaterials to solve problems related to energy storage, environmental remediation, and biomedical applications such as drug delivery and biosensing.
25CY61E1	Biosensors and Diagnostic Devices (Prof. Elective)	CO1	Apply the principles, components, fabrication techniques, and performance parameters of biosensors to design and evaluate effective sensor systems.
		CO2	Use the characterization techniques and transduction principles in biosensor-based detection.
		CO3	Demonstrate the fabrication and applications of key biosensors in clinical and environmental fields.

		CO4	Use the concepts of point-of-care devices, microfluidic platforms, and immunoassays in rapid and on-site diagnostics.
25UC5201	Professional Communication Skills	CO1	To develop and demonstrate principles of listening, speaking, reading, and writing in various functional contexts
		CO2	To demonstrate different types of personal and professional skills and apply them for growth in professional zone.
		CO3	Apply the concepts of Mathematical Principles to solve problems on Arithmetic, Algebra & Geometry to improve problem solving ability.
		CO4	Apply the concepts and using Logical thinking to solve problems on verbal & Non-Verbal Reasoning to develop Logical thinking skills.
25CY61E2	Instrumental Methods of Chemical Analysis (Prof. Elective)	CO1	Demonstrate the working mechanism and applications of voltametric techniques towards pharmaceutical drug analysis and environmental monitoring
		CO2	Illustrate the principle of fluorescence spectroscopy and apply it for clinical quantitative analysis
		CO3	Apply the basic principles of IR and Mass spectroscopy for the interpretation of organic molecules
		CO4	Apply the basic principles of thermal and radiochemical methods of analysis for the determination of stability of compounds and quantitative estimations of radioactive elements.
		CO5	Apply the key concepts of instrumentation techniques to set a procedure for the analysis of target species of interest and analyse the obtained results
25CY61E3	Advanced Separation and Chromatographic Techniques (Prof. Elective)	CO1	Apply the fundamental principles and theories of classical and modern separation techniques in analytical scenarios.
		CO2	Demonstrate the use of instrumentation and operational procedures in gas and liquid chromatography, including advanced techniques such as GC-MS and LC-MS.
		CO3	Implement solid and liquid phase separation methods such as electrophoresis, ion exchange, gel filtration, and solvent extraction for effective chemical analysis.
		CO4	Apply appropriate procedures to develop and validate analytical methods suited for industrial, environmental, and pharmaceutical applications.

25CY61E4	Applied Chemical Analysis (Prof. Elective)	CO1	Apply the principles, methodologies, and procedures to analyze ores such as Iron, Manganese, Chromite, Phosphate, and Aluminium.
		CO2	Demonstrate the application of general analytical methods for evaluating finished products including Steel, Dolomite, Fire Clay, Fluorspar, and Magnesite.
		CO3	Implement general methods of analysis to determine the composition of Cement, Soaps, Oils, and Paints.
		CO4	Apply relevant chemical and physicochemical principles to the analysis of Organic Functional Groups.
		CO5	Utilize appropriate instrumental techniques to conduct chemical analysis.
25CY61E6	Organic Synthesis (Prof. Elective)	CO1	Apply appropriate reagents and reaction conditions to achieve selective carbon- carbon bond formation.
		CO2	Use suitable reaction conditions, catalysts and reagents to carry out selective functionalization of organoboranes and silanes.
		CO3	Employ appropriate oxidizing and reducing agents and reaction conditions to achieve selective transformations.
		CO4	Apply synthetic strategies involving phase transfer catalysis and polymerization to carry out challenging organic reactions.
		CO5	Analyze reaction mechanisms and optimization strategies to execute multi-step synthetic routes for target molecule synthesis.
25CY61E7	Organic spectroscopy (Prof. Elective)	CO1	Apply UV-Visible spectroscopy to identify functional groups and predict molecular structure.
		CO2	Use IR spectroscopy to detect functional groups and analyze molecular structures.
		CO3	Interpret NMR spectra to deduce the structure of organic compounds.
		CO4	Analyze mass spectra and apply combined spectroscopic data to determine molecular structures.

25CY61E8	Natural Products & Heterocyclic Chemistry (Prof. Elective)	CO1	Apply extraction, biosynthesis, and spectroscopic methods to analyze and elucidate the structures and biological significance of alkaloids and steroids.
		CO2	Use isolation, synthesis, and characterization techniques to interpret the structures and biological roles of terpenoids and vitamins.
		CO3	Apply modern synthetic methods and catalytic strategies to synthesize aromatic heterocycles and analyze their biological significance.
		CO4	Use synthesis and green chemistry approaches to prepare and analyze aliphatic heterocycles, betaines, and meso-ionic compounds for diverse applications.
		CO5	Analyze isolation and synthetic methods to differentiate between natural and synthetic products and evaluate reaction outcomes for structural confirmation.
25IE6103	Term Paper	CO1	Exploring the Methodology of Retrieving Research Papers from Sci/Scopus Database.
		CO2	Gather information from journals, research database and deliver presentations.
25IE6205	Dissertation	CO1	Develop and publish a comprehensive research dissertation demonstrating advanced application of learned concepts.
		CO2	Develop a clear and feasible research question and design a robust methodology.

Academic Professor I/C

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