THE STANDARD FIREWORKS RAJARATNAM COLLEGE FOR WOMEN (AUTONOMOUS),
SIVAKASI – 626 123.
(Affiliated to Madurai Kamaraj University, Re-accredited with A+ Grade by NAAC,
College with Potential for Excellence by UGC and Mentor Institution under UGC PARAMARSH)

PG& RESEARCH DEPARTMENT OF CHEMISTRY

UG DEGREE PROGRAMME IN CHEMISTRY

PROGRAMME EDUCATIONAL OBJECTIVES	
The Graduates will	
PEO1.	pursue higher studies and satisfy the needs of analyst in industries and chemical laboratories.
PEO2.	possess skills of keen observation and drawing logical inferences from the practical experiments and adopt safety measures in the laboratory
PEO3.	emerge as a successful women entrepreneur to establish consultancies for quality analysis and small scale industries.

PROGRAMME LEARNING OUTCOMES	
By the Completion B.Sc. Chemistryprogramme, the learners will be able to	
PLO1.	Apply the knowledge of Arts, Science and Humanities to address fundamental and complex questions appropriate to their programmes.
PLO2.	Make use of appropriate knowledge and skills to identify, formulate, analyze and solve problems in order to reach substantiated conclusions.
PLO3.	Critically analyze research processes, products and practices with a view of strategic use of data in their field.
PLO4.	Demonstrate skills in oral and written communication and make use of ICT in various learning ambience.
PLO5.	Interact productively with people from diverse backgrounds as both leaders/mentors and team members with integrity and professionalism.
PLO6.	Defend the society against gender and environmental issues with moral and ethical awareness.
PLO7.	Formulate their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.

COURSE LEARNING OUTCOME

CORE COURSE	
Course Code:23GCC11	**Course Title: GENERAL CHEMISTRY-I**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the atomic structure, duality of matter, periodic properties, bonding and basic concepts in organic chemistry.
CLO2 [K3]	apply the theories of atomic structure and bonding to calculate electronegativity, percentage ionic character and bond order.
CLO3 [K4]	classify the elements in the periodic table, types of bonds and reagents, reaction intermediates, electronic effects in organic compounds.
CLO4 [K5]	evaluate the relationship between electronic configuration, bonding, geometry of molecules and reactions, structural reactivity and electronic effects
CLO5 [K6]	construct MO diagrams, predict trends in periodic properties, and explain hybridization in molecules and nature of bonding

CORE COURSE	
Course Code:23GCC1L	**Course Title: INORGANIC ESTIMATION & PREPARATION**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the basic principles involved in titrimetric analysis and inorganic preparations
CLO2 [K3]	apply and compare the methodologies of different titrimetric analysis
CLO3 [K4]	calculate the concentrations of unknown solutions in different ways
CLO4 [K5]	assess the yield of different inorganic preparations and identify the end point of various titrations.
CLO5 [K6]	develop principles and methods to estimate the different analytes.

FOUNDATION COURSE	
Course Code:23GCFC11	**Course Title: BASICS OF CHEMISTRY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the nomenclature of organic compounds, mole, colligative properties of dilute solutions, and types of reactions
CLO2 [K3]	apply the mole concept, colligative properties, IUPAC rule and hybridization.
CLO3 [K4]	comment on the expressions for colligative properties, structural formula from elemental analysis and stoichiometric equation and classify the types of reactions
CLO4 [K5]	interpret the empirical formula, effects of molecular forces, osmotic pressure, elevation of boiling point and depression of freezing point.
CLO5 [K6]	develop skills in IUPAC nomenclature, colligative properties, empirical formula and stoichiometry calculation

CORE COURSE	
Course Code:23GCC21	**Course Title: GENERAL CHEMISTRY-II**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the concept of acids, bases and ionic equilibria, periodic properties of s and p block elements, preparation and properties of aliphatic and aromatic hydrocarbons
CLO2 [K3]	identify the periodic trends of s and p- block elements, reactions of aliphaticand aromatic hydrocarbons and strength of acids
CLO3 [K4]	classify hydrocarbons, types of reactions, acids and bases, examine the properties andp-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons
CLO4 [K5]	assess the theories of acids, bases and indicators, buffer action and important compounds of s-block elements
CLO5 [K6]	propose the application of hard and soft acids indicators, buffers, compounds of sand p- block elements and hydrocarbons

CORE COURSE	
Course Code:23GCC2L	**Course Title: ORGANIC ANALYSIS & PREPARATION**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	observe the physical state, odour, colour and solubility of the given organic compound
CLO2 [K3]	identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.
CLO3 [K4]	compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non- reducing sugars and explain the reactions behind it.
CLO4 [K5]	confirm the identified functional group with solid derivative.
CLO5 [K6]	develop the strategies to analyze and prepare unknown organic compounds.

CORE COURSE	
Course Code:23GCC31	**Course Title: GENERAL CHEMISTRY– III**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the concept of various states of matter, nuclear chemistry and nomenclature, physical & chemical properties of organic compounds
CLO2 [K3]	identify the basic mechanisms of reactions of halo organic compounds and alcohols and apply the concepts of properties of matter and nuclear chemistry to solve problems
CLO3 [K4]	analyze the physical properties of states of matter and nuclear chemistry by deriving various expressions and compare the substitution reactions of halogen and alcoholic derivatives
CLO4 [K5]	assess the physical parameters of molecules.
CLO5 [K6]	develop the skills to predict the symmetry and solve problems in nuclear chemistry and states of matter.

CORE COURSE	
Course Code:23GCC3L	**Course Title:QUALITATIVE INORGANIC ANALYSIS**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	acquire knowledge on the systematic analysis of Mixture of salts.
CLO2 [K3]	identify the cations and anions in anunknown substance.
CLO3 [K4]	classify the cations and anions in the soil and water and to test the quality of water.
CLO4 [K5]	assess the role of common ion effect and solubility product
CLO5 [K6]	predict the interfering anion and eliminate the anion

SKILL ENHANCEMENT COURSE	
Course Code:23GCES3L	**Course Title:PREPARATION OF HOMECARE PRODUCTS**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the raw materials of the house hold products.
CLO2 [K3]	apply the chemical methods in the preparation of toiletry and house hold products.
CLO3 [K4]	analyze the role of the ingredients in the toiletry products.
CLO4 [K5]	assess the quality of ingredients
CLO5 [K6]	create ideas to improve the value of the products

SKILL ENHANCEMENT COURSE	
Course Code: 23GCDS31	**Course Title:FOOD CHEMISTRY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the concepts of food adulteration, food additives, food Poison, beverages and edible oils.
CLO2 [K3]	identify the ill effects of food poisons and beverages and the role of MUFA and PUFA
CLO3 [K4]	analyze the food adulterants and quality of oils and fats
CLO4 [K5]	assess the importance of food additives, beverages, edible oils and fats in food industries.
CLO5 [K6]	design methods to identify food poisons, and adulteration in food and reduce health hazards

CORE COURSE	
Course Code:23GCC41	**Course Title:GENERAL CHEMISTRY-IV**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the thermodynamical concepts, d block elements, preparation and properties of carbonyl compounds and principles of thermal, electrochemical analysis.
CLO2 [K3]	utilize the laws of thermodynamics, illustrate the properties of d block elements and the synthetic applications of carbonyl compounds.
CLO3 [K4]	compare the properties of transition elements and non-transition elements and various thermodynamic properties and processes.
CLO4 [K5]	appraise the law of thermodynamics and calculate the physical parameters

CLO5 [K6]	explore the applications of thermal and electrochemical techniques.
CORE COURSE	
Course Code:23GCC4L	**Course Title:PHYSICAL CHEMISTRY PRACTICAL-I**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the principle and methodology in the physical chemistry practical work
CLO2 [K3]	apply the principles of electrochemistry, kinetics for carrying out the practical work.
CLO3 [K4]	interpret the observed data with the laboratory ethics
CLO4 [K5]	evaluate the observed and recorded experimental data.
CLO5 [K6]	discover the skills for safe handling of the equipment and chemicals.

CORE COURSE	
Course Code:23GCC51	**Course Title:ORGANIC CHEMISTRY - I**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the preparation and properties of nitrogen containing compounds, heterocyclic compounds, dyes, food colours and additives.
CLO2 [K3]	identify the conformation and configuration of organic compounds.
CLO3 [K4]	illustrate the properties of nitrogen containing compounds and conformation and stability of organic compounds.
CLO4 [K5]	assess the aromaticity, basicity and acidity of organic compounds and the colour and constitution of dyes.
CLO5 [K6]	predict the nature and position of substituent in substitution reactions of heterocyclic and nitrogen containing compounds

CORE COURSE	
Course Code:23GCC52	**Course Title:INORGANIC CHEMISTRY-I**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain theories and preparation of coordination complexes, isomerism, EAN rule, inner transition elements and inorganic polymers
CLO2 [K3]	apply crystal field theory to predict magnetic and spectral properties of complexes.
CLO3 [K4]	compare the characteristics of lanthanoids and actinoids, VBT and CFT.
CLO4 [K5]	evaluate the properties of metal carbonyls and inorganic polymers.
CLO5 [K6]	compile the theories and applications of coordination compounds.

CORE COURSE	
Course Code:23GCC53	**Course Title:PHYSICAL CHEMISTRY- I**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the basic concepts of thermodynamics, kinetics, surface chemistry and photochemistry.
CLO2 [K3]	apply the laws of thermodynamics, kinetics, surface chemistry and photochemistry.
CLO3 [K4]	compare the adsorption isotherms, types of catalysis and photophysical processes.
CLO4 [K5]	assess the types and characteristics of colloids, preparation of sols and emulsions and determine the molecular weights of macromolecules.
CLO5 [K6]	propose the mechanism of reactions and solve problems related to thermodynamics and kinetics.

CORE COURSE	
Course Code:23GCC5P	**Course Title:PROJECT WITH VIVA-VOCE**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	review the literature in their respective research area.
CLO2 [K3]	adopt positive attitude and skill in research work and to know about the intellectual property rights in research.
CLO3 [K4]	analyze the research gap, design and execute the innovative research schemes with ethics.
CLO4 [K5]	appraise the characterization techniques in their research work
CLO5 [K6]	conclude the scientific results of their team projects.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code:23GCDE51	**Course Title:BIOCHEMISTRY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	outline the importance of lipids, amino acid, proteins, enzyme, blood and hormones in biological process.
CLO2 [K3]	apply methods to synthesize biomolecule such as amino acids, peptides and correlate its activity through their properties
CLO3 [K4]	analyse the factors influencing enzyme activity, and the structure and metabolism of biomolecules.
CLO4 [K5]	appraise the function of RNA and DNA, lipids, vitamins, amino acids and hormones
CLO5 [K6]	predict the biological significance of protein, lipids, vitamins, enzymes, amino acids and hormones

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code:23GCDE52	**Course Title: BIOMEDICAL INSTRUMENTATION TECHNIQUES**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	understand the modern medical equipments in hospitals and research institutes.
CLO2 [K3]	apply the recent advances in biomedical instrumentation.
CLO3 [K4]	compare the design and function of various medical equipments
CLO4 [K5]	assess the importance of biomedical equipments in the field of medicine
CLO5 [K6]	explore the usage of appropriate equipments with the relevant application

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code:23GCDE53	**Course Title:INDUSTRIAL CHEMISTRY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the properties of fuels, personal care and home care products and industrial preparation of sugar, leather, cement and soaps.
CLO2 [K3]	apply Intellectual property rights to industries and utilize the personal care, home care and industrially manufactured products in day today life.
CLO3 [K4]	illustrate the properties of fuels, personal and home care products.
CLO4 [K5]	interpret the various factors for patentability and methodologies adopted in the manufacture of sugar, leather cement and soaps.
CLO5 [K6]	formulate the appropriate trademarks, certification marks and design appropriate methodology in preparation of various personal care, home care and industrial products.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code:23GCDE54	**Course Title:PESTICIDE CHEMISTRY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the preparation and properties of pesticides, biopesticides
CLO2 [K3]	apply the pesticides action and effect in aquatic environment
CLO3 [K4]	demonstrate the extraction and toxicity of pesticide residues
CLO4 [K5]	analyze the pesticides residues through analytical methods
CLO5 [K6]	develop a route to synthesize pesticides.

CORE COURSE	
Course Code:23GCIN51	**Course Title:INTERNSHIP**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	relate the class room theory with work place practice.
CLO2 [K3]	apply the practices / procedures observed in real time working environment.
CLO3 [K4]	analyze the workflow and communication flow prevailing in the institution / industry.
CLO4 [K5]	assess interests and abilities in their field of study.
CLO5 [K6]	propose strategies, policies and guidelines for enhancing efficiency of industrial/institutional operations.

CORE COURSE	
Course Code:23GCC61	**Course Title:ORGANIC CHEMISTRY- II**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarise the preparation and properties of alkaloids, terpenes, Carbohydrates, synthetic reagents, and principles of green chemistry.
CLO2 [K3]	identify the products and steps in molecular rearrangements, applications of synthetic reagents in organic synthesis.
CLO3 [K4]	classify the biomolecules and natural products based on their structure, properties and reactions.
CLO4 [K5]	analyze the structure and importance of natural products, green and synthetic reagents.
CLO5 [K6]	propose the mechanism of the molecular rearrangements and design green routes for the synthesis of organic compounds.

CORE COURSE	
Course Code:23GCC62	**Course Title:INORGANIC CHEMISTRY - II**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the importance of tracer elements on biological systems, metallo enzymes, silicates, paints and nano composites.
CLO2 [K3]	identify the role of metal ion in transport, Bohr effect, Na, K, Ca pump in living systems.
CLO3 [K4]	illustrate the structure of silicates and constituents of paints.
CLO4 [K5]	evaluate the function of metalloenzymes.
CLO5 [K6]	construct the manufacturing process of refractories, explosives, paints and pigments.

CORE COURSE	
Course Code:23GCC63	**Course Title:PHYSICAL CHEMISTRY-II**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the principle and importance of phase rule, chemical equilibrium and electrochemistry
CLO2 [K3]	apply the Nernst distribution law, Clausius- Clayperon equation, phase rule to different systems
CLO3 [K4]	analyze the applications of electrochemistry, chemical equilibrium and phase diagrams
CLO4 [K5]	evaluate the factors affecting EMF, equilibrium constant and miscibility of mixtures
CLO5 [K6]	explore the knowledge in the industrial components based on electrochemistry.

CORE COURSE	
Course Code:23GCC6L	**Course Title:PHYSICAL CHEMISTRY PRACTICAL – II**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the principles and methodology for the practical work.
CLO2 [K3]	apply the principles of phase rule and electrochemistry for carrying out the practical work.
CLO3 [K4]	determine the strength of analytes electrometrically.
CLO4 [K5]	select appropriate method to determine the eutectic temperature,transition temperature and critical solution temperature
CLO5 [K6]	investigate laboratory skills for safe handling of the equipment and chemicals

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code:23GCDE61	**Course Title:PHYSICAL CHEMISTRY PRACTICAL – II**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the theory and principles of various spectral techniques.
CLO2 [K3]	apply selection rules to understand spectral transitions, Woodward – Fieser's rule to calculate the wavelength maximum of conjugated dienes.
CLO3 [K4]	analyse the applications of UV, IR, Raman, NMR spectroscopy and Mass spectrometry.
CLO4 [K5]	predict the structure of the compounds using various spectral data.
CLO5 [K6]	compile the applications of spectroscopy to distinguish the structure of compounds

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code:23GCDE62	**Course Title:PHARMACEUTICAL CHEMISTRY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarise, the concepts of pharmaceutical chemistry and its terminologies
CLO2 [K3]	apply structural activity relationship in drug designing, functions of haematological agents.
CLO3 [K4]	analyze the structural activity and physio- chemical properties of therapeutic agents, significance of medicinal plants and clinical tests
CLO4 [K5]	assess the importance of chemotherapeutic agents and their physiological functions.
CLO5 [K6]	explore the significance of clinical tests like blood urea, serum proteins and coronary risk index

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code:23GCDE63	**Course Title:NANO SCIENCE**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the general concepts and physical phenomena of relevance within the field of nanoscience.
CLO2 [K3]	determine the properties, synthesis, characteristics of nanomaterials, special nanomaterials and applications.
CLO3 [K4]	analyze the structure, properties, applicability and characterization of nano materials.
CLO4 [K5]	examine various synthesis procedures, characterizations and uses of carbon nanotubes, fullerene and graphene
CLO5 [K6]	design the nanomaterials of sensors and in optics and electronics

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code:23GCDE64	**Course Title:POLYMER SCIENCE**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	outline the polymers, elastomers, fibers, liquid resins, reaction and properties of polymer.
CLO2 [K3]	determine the molecular weight of polymers and illustrate the thermal properties of Polymers.
CLO3 [K4]	organize addition and condensation polymerization, mechanical properties of polymers.
CLO4 [K5]	examine the reactions of polymers and polymer processing.
CLO5 [K6]	design speciality polymers like PVC, PMMA, rubbers, biodegradable polymers.

GENERIC ELECTIVE COURSE	
Course Code:23GCEG11	**Course Title:CHEMISTRY FOR PHYSICAL SCIENCES-I**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarise the theories of chemical bonding, nuclear reactions and their applications.
CLO2 [K3]	identify an appropriate method for the separation and purification of chemical component and uses of fertilizers and fuel gases.
CLO3 [K4]	compare the type of hybridization, electronic effect and mechanism involved in the organic reactions.
CLO4 [K5]	appraise the thermodynamic principles and phase equilibria.
CLO5 [K6]	propose the applications of nuclear chemistry, analytical chemistry in various industries.

NON MAJOR ELECTIVE COURSE	
Course Code:23GCNE11	**Course Title: CHEMISTRY IN DAILY LIFE**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	paraphrase the ingredients of chemicals used in everyday life, food industry, cosmetics, drugs, fertilizers and outline the causes and effects of pollution.
CLO2 [K3]	apply methodologies in the preparation and usage of chemicals used in day today life and minimization of pollution.
CLO3 [K4]	classify fuels, fertilizers, personal, home care products, water and pollution.
CLO4 [K5]	assess the methodologies adopted in preparation and uses of building materials, fertilizers, fuels, drugs and explosives.
CLO5 [K6]	design the preparation of drugs, fertilizer, fuels, plastics and other home care products.

GENERIC ELECTIVE COURSE	
Course Code:23GCEG21	**Course Title:CHEMISTRY FOR PHYSICAL SCIENCES-II**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the principles of photochemistry and different theories to explain the bonding in coordination compounds and water technology.
CLO2 [K3]	apply the rules to name the inorganic complexes and demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.
CLO3 [K4]	classify the fuel cells, electrodes, photophysical processes, carbohydrates and amino acids.
CLO4 [K5]	appraise the photochemical processes, chemical kinetics, theories of coordination chemistry and water technological processes.
CLO5 [K6]	construct the Jablonski diagram for various photophysical processes and design new methodologies by incorporating titrimetric principles.

GENERIC ELECTIVE COURSE	
Course Code:23GCEG2L	**Course Title:PRACTICAL FOR PHYSICAL SCIENCES**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the basic principles involved in volumetric and organic analysis.
CLO2 [K3]	apply the principles of analytical chemistry to determine the quality of water
CLO3 [K4]	analyze the results of volumetric titration and identify the organic compounds
CLO4 [K5]	estimate the amount of substance present in given solutions and predict the functional group present in organic compound.
CLO5 [K6]	design synthetic route for the preparation of organic compounds and methods of titration of unknown compound.

NON MAJOR ELECTIVE COURSE	
Course Code:23GCNE21	**Course Title: COSMETICS AND PERSONAL GROOMING**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	outline the composition of various cosmetic products
CLO2 [K3]	choose the chemical aspects and applications of hair care, dental care and skin care products.
CLO3 [K4]	classify the perfumes, skin care and make up products.
CLO4 [K5]	deduce the methods of beauty treatments, their advantages and disadvantages
CLO5 [K6]	design and prepare various products by understanding the hazards of cosmetic products.

GENERIC ELECTIVE COURSE	
Course Code:23GCEG31	**Course Title:CHEMISTRY FOR BIOSCIENCES - I**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	outline the theories and importance of bonding, nuclear reactions, chemicals in industry, hybridization, separation techniques and the drugs.
CLO2 [K3]	apply the concepts of MO theory, principles of analytical methods and radioisotope.
CLO3 [K4]	classify the drugs, chemical reactions, hybridization, nuclear reaction and analytical techniques.
CLO4 [K5]	evaluate the role of various separation techniques, drug activity and determine mechanism of organic reactions.
CLO5 [K6]	propose appropriate techniques relevant to nuclear, industrial and pharmaceutical chemistry in day to day life.

GENERIC ELECTIVE COURSE	
Course Code:23GCEG41	**Course Title:CHEMISTRY FOR BIOSCIENCES - II**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the terms in coordination chemistry, biomolecules, biological function of aminoacid, protein, electrochemistry and photochemistry
CLO2 [K3]	apply the rules to name the complexes and the electrochemistry principles in corrosion, electroplating and fuel cells.
CLO3 [K4]	classify the fuel cells, electrodes, photophysical processes, carbohydrates and amino acids.
CLO4 [K5]	appraise the biological role of metals, amino acids and nucleic acids.
CLO5 [K6]	construct the Jablonski diagram, structure of carbohydrate and water purification methods.

GENERIC ELECTIVE COURSE	
Course Code:23GCEG4L	**Course Title:PRACTICAL FOR BIOSCIENCES**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the basic principles involved in volumetric and organic analysis.
CLO2 [K3]	apply the principles of analytical chemistry to determine the quality of water
CLO3 [K4]	analyze the results of volumetric titration and identify the organic compounds
CLO4 [K5]	estimate the amount of substance present in given solutions and predict the functional group present in organic compound.
CLO5 [K6]	design synthetic route for the preparation of organic compounds and methods of titration of unknown compound

SELF EMPLOYMENT COURSE	
Course Code:23GSE44	**Course Title: BASICS OF PRINTING TECHNOLOGY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the basic principles of mini offset, screen printing and modern printing processes.
CLO2 [K3]	apply the basics of printing processes and classify their types, inks, mesh materials.
CLO3 [K4]	analyze the advantages of different printing units and use of chemicals in printing industry
CLO4 [K5]	interpret the applications of screen printing and inkjet printing
CLO5 [K6]	explore the various processes and techniques in modern printing processes and techniques

SELF EMPLOYMENT COURSE	
Course Code:23GSE44L	**Course Title: PRINTING PRIMER PRACTICAL**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the basic principles of mini offset, screen printing and modern printing processes.
CLO2 [K3]	apply the basics of printing processes in preparing polymaster, screen and stencil
CLO3 [K4]	illustrate various methods in stencil preparation.
CLO4 [K5]	assess the mounting process in different printing machines
CLO5 [K6]	design more patterns using various modern printing processes and techniques

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PG & RESEARCH DEPARTMENT OF CHEMISTRY

PG DEGREE PROGRAMME IN CHEMISTRY

PROGRAMME EDUCATIONAL OBJECTIVES	
The Graduates will	
PEO1.	apply their competency and analytical skills gained for higher studies and able to be a professional analyst in research and development laboratories of pharmaceutical, pyrotechnique, paper and pulp and other chemical industries.
PEO2.	employ their critical thinking, scientific inquiry in the performance, design, interpretation and documentation of innovative research work with ethics, realizing the social, economic, environmental and technological implications of chemistry.
PEO3.	establish analytical laboratories and small scale industries, learning support centers for competitive examinations.

PROGRAMME LEARNING OUTCOMES	
By the Completion PG Degree programme, the learners will be able to	
PLO1.	Apply the knowledge of Arts, Science and Humanities to address fundamental and complex questions appropriate to their programmes.
PLO2.	Make use of appropriate knowledge and skills to identify, formulate, analyze and solve problems in order to reach substantiated conclusions.
PLO3.	Critically analyze research processes, products and practices with a view of strategic use of data in their field.
PLO4.	Demonstrate skills in oral and written communication and make use of ICT in various learning ambience.
PLO5.	Interact productively with people from diverse backgrounds as both leaders/mentors and team members with integrity and professionalism.
PLO6.	Defend the society against gender and environmental issues with moral and ethical awareness.
PLO7.	Formulate their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.

COURSE LEARNING OUTCOME

Core Course	
Course Code: 23PCC11	**Course Title: ORGANIC REACTION MECHANISM - I**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the concepts of stereochemistry, substitution reactions and Linear free energy relationship.
CLO2 [K3]	sketch the mechanism of substitution reactions and identify the conformation and configuration of organic compounds.
CLO3 [K4]	analyse the principles of kinetic and non-kinetic methods to determine the mechanism of reactions and reactivity.
CLO4 [K5]	assess the stability and reactivity of organic compounds based on the NGP, Conformational analysis and Linear free energy relationship
CLO5 [K6]	design organic compounds by correlating the stereochemistry of organic compounds

Core Course	
Course Code: 23PCC12	**Course Title: SOLID STATE CHEMISTRY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the basic concepts, techniques involved and defects found in solid state and outline the structure of main group compounds and clusters
CLO2 [K3]	determine the geometry and structure of inorganic compounds and its defects
CLO3 [K4]	compare the structural features of crystal system, and classify the defects, silicates, polyacid and techniques adopted in solid state chemistry
CLO4 [K5]	evaluate the physical properties of ionic crystals, structure of boranes, crystal growth methods and the effects of defects
CLO5 [K6]	predict the structure of main group compounds and clusters, point group and the sampling methods used in instrumental techniques

Core Course	
Course Code: 23PCC1L	**Course Title: ORGANIC CHEMISTRY PRACTICAL**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the basic principles of organic separation, qualitative analysis and preparation.
CLO2 [K3]	apply different separation methods for organic mixtures and identify its functional group
CLO3 [K4]	analyse separated organic mixtures and convert them as derivatives by suitable preparation method.
CLO4 [K5]	determine the correct method for separation of a binary mixture and make the separated compounds in pure form
CLO5 [K6]	formulate method of separation, analysis of organic mixtures and design suitable procedure for organic preparations.

DISCIPLINE SPECIFICELECTIVE COURSE	
Course Code: 23PCDE11	**Course Title: PHARMACEUTICAL CHEMISTRY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the properties of drugs and advanced concepts of pharmaceutical chemistry
CLO2 [K3]	apply isotopic dilution analysis, drug dosage and computer languages in drug discovery.
CLO3 [K4]	illustrate the physical and chemical properties of chemical compounds needed for drug action.
CLO4 [K5]	assess the knowledge of isotopic dilution, physicochemical properties of drug and QSAR.
CLO5 [K6]	predict the physicochemical properties, drug dosage and structural activities of lead like compounds

DISCIPLINE SPECIFICELECTIVE COURSE	
Course Code: 23PCDE12	**Course Title: NANO MATERIALS & NANO TECHNOLOGY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the concept of nano materials and nano technology
CLO2 [K3]	apply important nano materials synthetically
CLO3 [K4]	correlate the characteristics of various nano materials synthesized by new technologies
CLO4 [K5]	prioritize the experimental techniques that can be used on the nanoscale for characterization
CLO5 [K6]	design synthetic routes for new nano materials

DISCIPLINE SPECIFICELECTIVE COURSE	
Course Code: 23PCDE13	**Course Title: ELECTROCHEMISTRY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the behavior & theories of electrolytes in solution, behavior of electrodes, modes of transport of electroactive species and principles of energy storage systems.
CLO2 [K3]	apply the electrode mechanism to study the working of electrodes and to identify the kinetics of electrode reactions applying Butler-Volmer and Tafel equations
CLO3 [K4]	compare the structures of electrode - electrolyte interface and relation between current density and over potential
CLO4 [K5]	evaluate the electrode - electrolyte interface, electrodics and concentration polarization.
CLO5 [K6]	design energy storage and energy production systems.

DISCIPLINE SPECIFICELECTIVE COURSE	
Course Code: 23PCDE14	**Course Title: MEDICINAL CHEMISTRY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the knowledge of chemotherapeutic agents and receptors.
CLO2 [K3]	identify the uses of various chemotherapeutic agents and factors affecting the drug action.
CLO3 [K4]	illustrate the relation between chemical structure and pharmaceutical activity and suitable drugs for various diseases
CLO4 [K5]	interpret the mechanism of action and adverse effects of various drugs.
CLO5 [K6]	formulate the method for treatment of diseases using drugs.

CORE COURSE	
Course Code: 23PCC21	**Course Title: -ORGANIC REACTION MECHANISM-II**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the mechanism involved in various organic reactions and uses of reagents.
CLO2 [K3]	apply the concept of orientation and reactivity to hydrogenation of double and triple bonds
CLO3 [K4]	predict the suitable reagents and mechanism for the conversion of selective organic compounds.
CLO4 [K5]	correlate the principles of substitution, elimination, and addition reactions.
CLO5 [K6]	design routes to synthesize organic compounds using reagents.

CORE COURSE	
Course Code: 23PCC22	**Course Title: PHYSICAL CHEMISTRY-I**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the fundamentals of kinetics of reactions, thermodynamics and the composition of partial molar quantities.
CLO2 [K3]	apply the classical and statistical approach of the functions in thermodynamics and kinetics.
CLO3 [K4]	compare the significance of Maxwell-Boltzman, Fermi-Dirac and Bose-Einstein and correlate the theories of reaction rates for the evaluation of thermodynamic parameters.
CLO4 [K5]	prioritize the concept of thermodynamics, mechanism and kinetics of chemical reactions.
CLO5 [K6]	propose kinetics of reactions and arrive at solutions for problems in thermodynamics and statistical thermodynamics

CORE COURSE	
Course Code: 23PCC2L	**Course Title: INORGANIC CHEMISTRY PRACTICAL**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	outline the procedure for qualitative analysis, inorganic preparations and complexometric titrations
CLO2 [K3]	identify the ions, prepare inorganic complexes and apply the law of volumetric analysis
CLO3 [K4]	detect the cations into the groups and to mask the selective ions with suitable agents
CLO4 [K5]	estimate the analytes using complexometric titration.
CLO5 [K6]	synthesize coordination compounds in pure form.

DISCIPLINE SPECIFICELECTIVE COURSE	
Course Code: 23PCDE21	**Course Title: MOLECULAR SPECTROSCOPY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the principle and importance of various spectroscopic techniques and lasers.
CLO2 [K3]	apply the various spectroscopic principles to diatomic and polyatomic molecules
CLO3 [K4]	analyze spectral activity of molecules; examine the transitions between rotational, vibrational, electronic and spin energy levels
CLO4 [K5]	evaluate the factors affecting chemical shift in NMR; hyperfine and zero-field splitting in ESR spectra
CLO5 [K6]	construct the structure of simple molecules using Mass sspectrometry, EPR and Mossbauer Spectroscopy techniques

DISCIPLINE SPECIFICELECTIVE COURSE	
Course Code: 23PCDE22	**Course Title: GREEN CHEMISTRY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the basic chemical techniques used in conventional industrial preparations and in green innovations
CLO2 [K3]	apply the principles of PTC, ionic liquid, microwave and ultrasonic assisted organic synthesis.
CLO3 [K4]	compare the advantages of organic reactions assisted by renewable energy sources and non-renewable energy sources
CLO4 [K5]	assess the importance of green solvents and techniques in chemical industries and in laboratory
CLO5 [K6]	design and synthesize organic compounds by green methods.

SKILLENHANCEMENTCOURSE	
Course Code: 23PCSE2L	**Course Title: COMPUTATIONAL CHEMISTRY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the concepts of computer technology in chemistry and its manifestations
CLO2 [K3]	apply the docking methods and QSAR in drug designing
CLO3 [K4]	examine the principles of drug discovery, QSAR, ADMET and molecular modeling.
CLO4 [K5]	assess the importance of Cheminformatics in modern drug research
CLO5 [K6]	predict the drug like activity of the chemical compounds.

CORE COURSE	
Course Code:23PCC31	**Course Title: PERICYCLIC AND PHOTOCHEMISTRY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the concepts of retrosynthetic analysis, pericyclic reactions and photochemistry.
CLO2 [K3]	apply correlation and Molecular Orbital approaches to study the feasibility of pericyclic reactions
CLO3 [K4]	analyze the importance of protecting groups and various synthetic methods in synthesizing organic compounds
CLO4 [K5]	assess various pericyclic and photochemical reactions.
CLO5 [K6]	design and synthesize novel organic compounds with the retrosynthetic and pericyclic methodologies

CORE COURSE	
Course Code:23PCC32	**Course Title: COORDINATION CHEMISTRY – I**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the modern theories, spectral characteristics, stability and magnetic properties, and electron transfer mechanism of coordination compounds.
CLO2 [K3]	apply modern theories of coordination compounds
CLO3 [K4]	.analyze spectral characteristics, stability and magnetic property of the complexes.
CLO4 [K5]	predict the electronic transitions in a complex based on correlation diagrams and UV-Visible spectral details
CLO5 [K6]	propose the kinetics and mechanism of substitution reactions in octahedral and square planar complexes

CORE COURSE	
Course Code:23PCC3L	**Course Title: PHYSICAL CHEMISTRY PRACTICAL**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the principles associated with various physical chemistry experiments
CLO2 [K3]	calculate and process the experimentally measured values
CLO3 [K4]	interpret the experimental data scientifically and compare with graphical data
CLO4 [K5]	evaluate the data to improve efficiency for societal developments
CLO5 [K6]	design phase diagrams and derive kinetics of the given reactions

DISCIPLINE SPECIFICELECTIVE COURSE	
Course Code:23PCDE31	**Course Title: PHARMACOGNOSY AND PHYTOCHEMISTRY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarises the nomenclature, structure and properties of natural products and analysis of crude drugs.
CLO2 [K3]	apply various techniques to discover new alternative medicines
CLO3 [K4]	classify the secondary metabolites including**t**erpenoids, alkaloids, saponins and volatile oils.
CLO4 [K5]	analyze the extraction techniques to extract the primary and secondary metabolites, isolation methods and separation of bioactive compounds.
CLO5 [K6]	find the application of natural products in pharmacological field.

DISCIPLINE SPECIFICELECTIVE COURSE	
Course Code:23PCDE32	**Course Title: BIOMOLECULES AND HETEROCYCLICS**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the basic concepts, nomenclature, structure, synthesis and properties of biomolecules and heterocycles.
CLO2 [K3]	elucidate and assess the different methods of preparation and functions of biomolecules.
CLO3 [K4]	classify the secondary metabolites includingsteroids, hormones, proteins, saccharides and lipids and illustrate their applications and functions.
CLO4 [K5]	integrate the structure of biomolecules and heterocyclic compounds.
CLO5 [K6]	arrive at the structure of biologically important heterocyclic compounds by different methods.

CORE COURSE		
Course Code:23PCCI31		**Course Title: INDUSTRY MODULES FOR CHEMIST**
On successful completion of the course, the learners should be able to		
CLO1 [K2]	summarize environmental sampling methods, manufacturing pyrotechnic process, dyeing process and laboratory practice.	
CLO2 [K3]	synthesize various dyes and explain dying process.	
CLO3 [K4]	compare the sampling techniques of air, water and soil.	
CLO4 [K5]	assure and accreditatethe quality laboratory practices.	
CLO5 [K6]	predict the nature of dyes and their handling	

CORE COURSE		
Course Code:23PCIN31		**Course Title: INTERNSHIP**
On successful completion of the course, the learners should be able to		
CLO1 [K2]	relate the class room theory with work place practice	
CLO2 [K3]	apply the practices / procedures observed in real time working environment	
CLO3 [K4]	analyze the workflow and communication flow prevailing in the institution/industry	
CLO4 [K5]	assess interests and abilities in their field of study	
CLO5 [K6]	propose strategies, policies and guidelines for enhancing efficiency of industrial/institutional operations	

SKILL ENHANCEMENT COURSE	
Course Code:23PCSE31	**Course Title: RESEARCH METHODOLOGY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the concepts of literature survey, report writing, plagiarism and IPR
CLO2 [K3]	apply research tools and internet resources to identify the research problems
CLO3 [K4]	explore the importance of intellectual property rights
CLO4 [K5]	assess the quality of report writing through plagiarism softwares.
CLO5 [K6]	design the research problems and find solutions

CORE COURSE	
Course Code:23PCC41	**Course Title: COORDINATION CHEMISTRY – II**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize thereactions of organometallic compounds and the principles of inorganic spectroscopy.
CLO2 [K3]	apply EAN rule and spectroscopic techniques to determine the structure and bonding in organometallic compounds.
CLO3 [K4]	differentiate the various reactions and catalysis of organometallic compounds
CLO4 [K5]	interpret the structure of homonuclear and heteronuclear diatomic molecules using PES.
CLO5 [K6]	predict the structure of coordination complexes using spectroscopic tools such as IR, NMR, ESR, Mossbauer and optical rotatory dispersion.

CORE COURSE	
Course Code:23PCC42	**Course Title: PHYSICAL CHEMISTRY- II**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the characteristics of wave functions and symmetry functions
CLO2 [K3]	apply the concept of quantum mechanics and group theory to predict the electronic structure
CLO3 [K4]	classify the symmetry operation and wave equations and to deduce the group theoretical irreducible representations and wave equations.
CLO4 [K5]	evaluate wave function and energy using approximation methods.
CLO5 [K6]	predict the point groups, vibrational modes and hybridization.

CORE COURSE	
Course Code:23PCC4L	**Course Title: INSTRUMENTAL ANALYSIS**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	outline the principles associated with various inorganic, organic and physical chemistry experiments
CLO2 [K3]	apply, observe and record systematically the readings in all the experiments
CLO3 [K4]	calculate and process the experimentally measured values and compare with graphical data.
CLO4 [K5]	interpret the experimental data scientifically to improve student's efficiency for societal developments.
CLO5 [K6]	plan and perform all the experiments scientifically

CORE COURSE	
Course Code:23PCC4P	**Course Title: PROJECT WITH VIVA-VOCE**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	review the literature in their respective research area.
CLO2 [K3]	adopt positive attitude and skill in research work and to know about the intellectual property rights in research.
CLO3 [K4]	analyze the research gap, design and execute the innovative research schemes with ethics.
CLO4 [K5]	appraise the characterization techniques in their research work
CLO5 [K6]	conclude the scientific results of their team projects.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code:23PCDE41	**Course Title: CHEMISTRY OF NATURAL PRODUCTS**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the basic concepts, nomenclature, structure and properties of the biological importance of biomolecules and natural products.
CLO2 [K3]	elucidate and characterize the biomolecules and the synthesized natural products.
CLO3 [K4]	Classify the biomolecules and natural products.
CLO4 [K5]	isolate the structure of alkaloids, terpenoids, carotenoids, flavanoids and anthocyanins.
CLO5 [K6]	determine the structure of natural products from different methods

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code:23PCDE42	**Course Title: POLYMER CHEMISTRY**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the types of polymerization, polymer degradation, polymer processing, synthetic polymers and molecular weights.
CLO2 [K3]	calculate the molecular weight by physical and chemical methods scientifically plan and perform the various polymerization reactions.
CLO3 [K4]	analyze the processing of polymers, techniques of polymerization and polymer degradation.
CLO4 [K5]	interpret the experimental methods to improve the quality of synthetic polymers
CLO5 [K6]	predict the degradation of polymers and catalyst suitable for polymerization process.

SKILL ENHANCEMENT COURSE	
Course Code:23PCSE41	**Course Title: CRACKING COMPETITIVE EXAMINATIONS**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	summarize the fundamentals of physical, inorganic and organic chemistry.
CLO2 [K3]	apply cognitive abilities to solve quantitative and qualitative problems and solve various problems in chemistry
CLO3 [K4]	analyze the structure of organic and inorganic molecules by physical methods.
CLO4 [K5]	solve the problems and find solutions with scientific reasoning.
CLO5 [K6]	interpret the structure of the compounds using analytical and spectroscopic techniques

SOFT SKILLCOURSE	
Course Code:23PCSS41	**Course Title: CHEMINFORMATICS**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the usage of cheminformatics software.
CLO2 [K3]	apply Insilco methods for interpretation of results.
CLO3 [K4]	analyze the quantum mechanical properties of chemical compounds using Gaussian software and Avogadro Software.
CLO4 [K5]	assess the lead like nature of chemical compounds using cheminformatics software
CLO5 [K6]	design novel drugs using software

GENERICELECTIVE COURSE	
Course Code:23PCEG21	**Course Title: SAFETY FIREWORKS**
On successful completion of the course, the learners should be able to	
CLO1 [K2]	outline the history, hazards, general rules, guidelines, chemistry of raw materials and safety aspects of firework industry.
CLO2 [K3]	identify the hazards and factors responsible for fire accidents.
CLO3 [K4]	analyse the properties of raw materials and safety manufacturing methods of fireworks products.
CLO4 [K5]	assess the safety methods to prevent accidents.
CLO5 [K6]	explore safety manufacturing methods in pyrotechnic industry.