F.Y.B.Sc Chemistry

Programme Specific Outcomes	
PSO1	The students will have sound understanding of fundamental and application-based principles and theories in Physical, Inorganic, Organic and Analytical Chemistry
PSO2	Students will learn various techniques to perform scientific experiments as well as accurately record and analyse the results of such experiments
PSO3	Student will learn the usage of analytical instruments, select, and apply appropriate techniques and resources for the analysis
PSO4	Extensive laboratory and classroom work will skill the students with in problem solving, critical thinking and analytical reasoning as applied to scientific problems.
PSO5	Students will be acquainted with new areas in both chemistry and allied fields of science and technology
PSO6	Students will understand the applications and impact of the chemistry in societal, and environmental contexts, and demonstrate its knowledge and need for sustainable development
PSO7	Students will learn to apply ethical practices such as limited and safe use of hazardous chemicals, responsibility toward environmental and health safety
PSO8	Solving, critical thinking and analytical reasoning as applied to scientific problems
PSO9	Students will be able to work in team and thus get prepared as a perfect professional chemist with respect to knowledge, responsibility and teamwork

Course Outcomes		
F.Y.B.Sc. Semester I		
Course (Paper) Name and No.- **Chemistry – I**		
CO1	Recall thermodynamics terms, the first law of thermodynamics and terms like normality, and molarity.	
CO2	Solve the Numerical problems based on the Concentration of solutions	
CO3	Classify the elements according to electronic configuration and explain details of periodic trends and atomic structure.	
CO 4	Explain the name, bonding, structure and bond fission of organic compounds.	
Course (Paper) Name and No.- **Chemistry Practical-I**		
CO 1	Find the exact concentrations of the solutions and enthalpy of dissolution.	
CO 2	Apply chemical kinetics law to calculate the rate constant of the	

	reaction.	
CO 3	Find the normality of the acids and bases and the purity of the samples gravimetrically.	
CO 4	Apply Thin Layer Chromatography (TLC) , Distillation, Recrystallization, and sublimation methods for separation of mixtures.	

Course (Paper) Name and No -- **Techniques in Environmental Analysis-I** (SEC)		
CO1	Find the p^H, Acidity, and Alkalinity of the given water samples.	
CO2	Analyze the solid pollutant present in the water samples.	
CO3	Determine the total hardness and purity of the given water samples.	

Semester II		
Course (Paper) Name and No-- **General Chemistry – II**		
CO 1	Explain the rules of integration , derivatives.	
CO 2	Outline the metallic and non-metallic nature, oxidation states, electronegativity, Anomalous behaviour and allotropy of main group elements.	
CO 3	Explain the reactivity of group 1 and group 2 elements and the effects of Oxides of carbon, sulfur and nitrogen on the environment.	
CO 4	Define surface tension, Viscosity, Refractive index of Liquid, Order of reaction.	
Course (Paper) Name and No-- **Chemistry Practical-II**		
CO 1	Apply chemical kinetics law to calculate the rate constant of reaction.	
CO 2	Make use of a colorimeter and pH meter.	
CO 3	Identify organic compounds containing C,H (O) N, S, X elements.	
CO 4	Identify cations and anions from the given mixture of compounds and the percentage of metal present in the sample by titration.	

Course (Paper) Name and No-- **Techniques in Environmental Analysis-II** (SEC)		
CO1	Identify the quality of soil of the surroundings.	
CO2	Develop the environmental control plan for environment pollution problem.	
CO3	Classify the various samples of soil according to their purity	
CO4	Discover the various components of soil.	

Course Outcomes **Semester III S.Y.B.Sc.**		
Course (Paper) Name and No.- **Physical and Analytical Chemistry Major-I**		
CO1	Illustrate the equation of Gibbs free energy, Chemical potential.	
CO2	Explain the concept of conductivity, electrolyte, transport number.	

CO3	Analyze the sampling of solids, liquids and gases compounds.	
CO4	Classify the various analytical methods	
Course (Paper) Name and No.- **Inorganic and Organic Chemistry-II Major-II**		
CO1	Construct the names and methods of preparation of carbonyl group compounds and role of active methylene compounds.	
CO2	Understand how the ring structure of cycloalkanes affect their stability.	
CO3	Construct the molecular orbital diagram of homonuclear diatomic molecules.	
CO4	Apply molecular orbital theory to diatomic and polyatomic molecules.	
Course (Paper) Name and No.- **Major Chemistry -Practical**		
CO1	Demonstrate the skills in organic preparations.	
CO2	Decide the cations and anions in the given mixture.	
CO3	Utilize the conductometer, pH meter. Colorimeter, potentiometer.	
CO4	Explain the gravimetric estimations and chemical kinetics.	
Course (Paper) Name : **Indian Knowledge System (IKS)**		
CO1	Explain the constitution and properties of matter, atomism in Vaisesika, and early chemical techniques used in ancient India.	
CO2	Discuss the contributions of ancient Indian scholars like Nagarjuna, Kanad, Charak, and Susruta, along with modern Indian scientists such as CV Raman and Vikram Sarabhai.	
CO3	Describe the development of acid and base concepts from organic and plant-based sources to the use of mineral acids in medieval India.	
CO4	Examine the mining, ore extraction, and metalworking technologies of ancient India, including the production of gold, zinc, copper, iron, and steel, as well as glass and metal casting techniques.	
Course (Paper) Name : **Fundamentals of Chemistry-I Minor**		
CO1	Define surface tension, viscosity of Liquid, Ideal gas and real gas.	
CO2	Explain the classical, non-classical methods and sampling in chemistry Show the preparation, estimation of organic compounds.	
CO3	Explain the reactions of alkanes and alkenes.	
CO4	Identify the shapes of molecules with and without lone pair of electrons and the oxidation number of elements to balance the redox equations.	
Course (Paper) Name : **Minor Practical**		
CO1	Apply chemical kinetics law to calculate the rate constant of the reactions.	
CO2	Make use of conductometer, pH meter, potentiometer for the determination of various ions in the given solution.	
CO3	Show the preparation, estimation of organic compounds.	
CO4	Identify organic compound containing C, H (O) N, S, X elements.	

Course (Paper) Name : **Chemistry in Everyday Life –Open Electives**		
CO1	Classify the various medicines and it's used in daily life.	
CO2	Create awareness among the society.	
CO3	Understand the basis knowledge and food adulteration and preservation	
Course (Paper) Name : **Chemistry of soap, food & perfumes -SEC**		
CO1	Explain the principle and production process of industrial soap and perfumes.	
CO2	Apply the skills to identify the adulterants in foods.	
CO3	Determine the acid and iodine value of given oil or fat samples.	
CO4	Find the calcium, vitamin C, iron content in the food samples	
Course Outcomes **Semester IV S.Y.B.Sc.**		
Course (Paper) Name and No.- **Physical and Analytical Chemistry Major-I**		
CO1	Explain reversible and irreversible cells, equilibrium constant, pH determination, Electrochemical series.	
CO2	Determine the end point and equivalence point of neutralization titrations	
CO3	Find the normality, molarity, formality of the samples.	
CO4	Construct the phase diagram of one and two component system.	

Course (Paper) Name and No.- **Inorganic and Organic Chemistry Major-II**		
CO1	Outline the synthesis and reaction of amines.	
CO2	Compare the different properties, reactions and reactivity of alcohols and phenols.	
CO3	Understand basic concepts of coordination compounds.	
CO4	Apply IUPAC nomenclature rules for coordination compounds.	
Course (Paper) Name and No.- **General Chemistry Major-III**		
CO1	Apply X-rays diffraction method to study crystal lattice structure of NaCl and KCl.	
CO2	Name the various analytical Instrumental methods in analytical chemistry	
CO3	Explain the preparation and structure of Boron, Silicon and Germanium compounds.	
CO4	Analyze structure, physical properties, acidity and reactions of carboxylic acids	
Course (Paper) Name and No.- **Major Practical**		
CO1	Identify the functional group of given compound and determine its mp/bp.	
CO2	Explain the working of conductometer and potentiometer.	
CO3	Determine the name and structure of organic compound	
CO4	Demonstrate the skills in inorganic preparations	

Course (Paper) Name and No.- **Fundamentals of Chemistry-II Minor**		
CO1	Explain the law of crystallography, types of crystal, interplanar distance in lattice	
CO2	Outline the metallic and non-metallic nature, oxidation states, electronegativity, Anomalous behaviour and allotropy of main group elements.	
CO3	Explain enantiomer, optical activity, diastereomers, projection formulas, isomerism.	
CO4	Outline the principles and preparations of titrimetric analysis	
Course (Paper) Name and No**.- Minor Practical**		
CO 1	Show the amount of ions present in the given solutions.	
CO2	Make use of potentiometer, pH meter, conductometer for the chemical reactions.	
CO3	Explain the estimation, preparation of organic compounds.	
CO4	Determine the rate constant of the chemical reaction	
Course (Paper) Name and No**.- Open Elective Molecules of life**		
CO1	Classify vitamins and its uses	
CO2	Explain proteins, carbohydrates and fats	
CO3	Create an awareness regarding steroids and hormone	

Course (Paper) Name and No: Community Engagement Project (CEP)

T.Y.B.Sc.

Programme Specific Outcomes

PSO1	Demonstrate in-depth knowledge of fundamental and advanced concepts in Inorganic, Organic, Physical, Analytical and Industrial Chemistry.
PSO2	Apply chemical principles to solve real-world problems in industries, research, and environmental contexts, making Chemistry relevant and meaningful.
PSO3	Develop and execute chemical experiments with accuracy and precision using modern laboratory techniques, including hyphenated and instrumental methods.
PSO4	Exhibit the ability to analyze, interpret data, and solve chemical problems through logical reasoning and scientific approach.
PSO5	Choose elective subjects that align with individual interests and career goals, facilitated by the Choice Based Credit System (CBCS).
PSO6	Prepare for academic and industrial research by understanding chemical processes, safety protocols, and laboratory management.
PSO7	Understand theoretical frameworks and chemical models that explain reactivity, mechanisms, and properties of substances.
PSO8	Relate chemistry knowledge with other sciences like physics, biology, and environmental science to build interdisciplinary competence.
PSO9	Develop a professional attitude, scientific ethics, and effective communication skills suitable for further education and employment.
PSO10	Cultivate a mindset for continuous learning and innovation by keeping pace with current developments and technological advances in Chemistry.

Course Outcomes

T.Y.B.Sc. Semester V

Course (Paper) Name and No.- **Physical Chemistry and Analytical chemistry Major-I**	
CO1	Differentiate Rotational Spectroscopy, Vibrational Spectroscopy, Raman Spectroscopy and NMR Spectrometer.
CO2	Explain G.M. Counter and Scintillation Counter methods, Freundlich Adsorption Isotherm, Langmuir Adsorption Isotherm and important terms of radioactivity and Surface tension.
CO3	Explain the theoretical principals of titrations and apply them for end point detection and selection of suitable indicators
CO4	Apply the Nernst law to the solvent extraction and describe the principles and processes of solvent extraction and solid phase extraction
CO5	Explain the fundamental principles, instrumentation and working of spectroscopic techniques and apply them for scientific problems
Course (Paper) Name and No.- **Major - II Inorganic and Organic Chemistry**	

CO1	Explain concept of Superconductivity, types of super conductors and its applications, Imperfections in solids and their effect on properties, Explain electrical properties of conductors, insulators and semiconductors on the basis of Band Theory.	
CO2	Assign the point group for given molecules using basic concepts of molecular symmetry and Construct molecular orbital diagrams for heteronuclear diatomic molecules and polyatomic Species.	
CO3	Determine packing density of different types of cubic unit cells	
CO4	Apply the concepts in writing and predicting the mechanism of organic reactions.	
CO5	Understand the spectral characteristics of organic compounds for its structure elucidation	
Course (Paper) Name and No.-**Major-IIII Practical's**		
CO1	Handle and understanding principle of instruments such as colorimetry, potentiometry, and conductometry, determining the molecular weight of high polymers like polyvinyl alcohol through viscosity measurements, and graphically interpreting reaction order from experimental data to calculate the specific rate constant.	
CO2	Demonstrate the skills in quantitative analysis and apply appropriate methods to obtain experimental data and interpret it and Apply their skills and knowledge to analyze various raw materials/finished products/environmental samples.	
CO3	Develop the practical skills for preparation of different inorganic metal complexes and Examine the percentage purity of the inorganic compounds qualitativelyand quantitively and impurity identification	
CO4	Identify chemical type of components present in binary mixture of solid-solid mixture and unknown organic compound by micro-scale technique and Apply skills in the separation and qualitative analysis of organic compounds of solid-solid mixtures by micro-scale technique	

Course (Paper) Name and No.- **Minor- Advanced Chemistry-I**		
CO1	Discuss properties of solids and rate laws	
CO2	Explain Valence Bond Theory (VBT) and solve problem based on it.	
CO3	Describe advanced separation techniques	
CO4	Discuss structure and functions of biomolecules and predict mechanism of organic reactions	
Course (Paper) Name and **No.- Minor- Advanced Chemistry-I Practical**		
CO1	Handle and understanding principle of instruments such as colorimetry, potentiometry, and conductometry, determining the molecular weight of high polymers like polyvinyl alcohol through viscosity measurements, and graphically interpreting reaction order from experimental data to calculate the specific rate constant.	
CO2	Demonstrate the skills in quantitative analysis and apply appropriate methods to obtain experimental data and interpret it and Apply their skills and knowledge to analyze various raw materials/finished products/environmental samples.	
CO3	Develop the practical skills for preparation of different inorganic metal complexes and Examine the percentage purity of the inorganic compounds qualitativelyand quantitively and impurity identification.	
CO4	Identify chemical type of components present in binary mixture of solid-solid mixture and unknown organic compound by micro-scale technique and Apply skills in the separation and qualitative analysis of organic compounds of solid-solid mixtures by micro-scale technique	
Course (Paper) Name and No**.- VSC-Instrumental techniques for pharmaceutical, chemical, and food testing**		
CO1	Perform the sample analysis using high-end instruments	
CO2	Perform calibration and other practical and safety aspects of Chemistry laboratory	
CO3	Analyze and interpret the data	
CO4	Apply the skills for professional development	
Course (Paper) Name and No: **VSC- Laboratory Experimental Techniques**		
CO1	Apply green methods for preparation of organic compounds.	
CO2	Apply skills of laboratory techniques in the separation and purification of organic compounds	
CO3	Interpret the functional groups of organic compounds by IR Spectroscopy	
Course (Paper) Name and No: **Pharmaceuticals and Colorants** **Elective-1**		
CO1	Students will understand the fundamentals of drugs, including definitions,	

	classifications, drug administration routes, and key pharmacological terms	
CO2	Students will gain knowledge of various drug classes (analgesics, antihistamines, cardiovascular drugs, etc.), their mechanisms of action, therapeutic uses, and chemical structures.	
CO3	Students will explore the properties and applications of natural and synthetic dyes, dyeing methods, and types of fibres, along with an understanding of optical brighteners used in the textile industry.	
Course (Paper) Name and No: **Industrial Chemistry** **Elective-2**		
CO1	Students will understand key concepts in industrial chemistry, including chemical production processes, quality control, safety measures, and legal aspects such as patents and trademarks.	
CO2	Students will learn the processes involved in cane sugar production, including refining, crystallization, and the role of by-products like bagasse and cellotex.	
CO3	Students will study the synthesis of industrial organic compounds such as methanol, isopropanol, acetone, acetylene, and toluene through various processes.	
Course (Paper) Name and No **--Practical's of Elective**		
CO1	To develop hands-on skills in drug synthesis, dosage form preparation, and pharmacological testing, gaining practical experience in drug formulation and analysis.	
CO2	To acquire proficiency in dyeing techniques, understanding the properties of natural and synthetic dyes, and applying them to different substrates for various textile applications.	
	Course Outcomes **Semester VI T.Y.B.Sc.**	
Course (Paper) Name and No **Physical and Analytical Chemistry Major-I**		
CO1	Explain types of polymers with specific examples of different polymers	
CO2	Differentiate between classical and quantum mechanics and derive equation of Elevation in boiling point and depression in freezing point of a solution	
CO3	Understand basics of chromatography and describe underlying principle, instrumentation and working of advanced separation methods such as GC, HPLC and Ion-Exchange Chromatography	
CO4	Understand and explain the fundamentals and working of electro analytical techniques such as polarography and amperometry.	
CO5	Explain the role of quality control and quality assurance in Industry.	

Course (Paper) Name and No **Inorganic and Organic Chemistry Major-II**		
CO1	Construct molecular orbital diagram of different coordination compounds, Analyze the electronic spectra of complexes.	
CO2	Measure Crystal field stabilization energy (CFSE) for octahedral complexes using basic concepts of Crystal Field Theory.	
CO3	Explain stereoselectivity, stereospecificity, mechanism and stereochemistry of substitution, elimination and addition and rearrangement reactions.	
CO4	Analyse individual or combined UV-VIS, IR and PMR spectral data spectral data for structure elucidation of simple organic compounds.	
	Course (Paper) Name and No **Major III- Practicals**	
CO1	Determine molecular weight by Rast method and order of reaction by fractional change method and Explain the adsorption phenomenon and the validity of adsorption isotherm and Demonstrate practical skills based on instruments such as conductometry, pH meter, potentiometry.	
CO2	Demonstrate laboratory skills in combined aspects of organic/inorganic analysis and Apply analytical skill for analysing real-world samples	
CO3	Develop the practical skills for preparation of different inorganic metal complexes and Examine the percentage purity of the inorganic compounds qualitativelyand quantitively and impurity identification.	
CO4	Demonstrate the separation of the liquid-liquid and solid-liquid mixtures by distillation and Apply skills in the separation and qualitative analysis of organic compounds of liquid-liquid and Liquid-solid mixtures by micro-scale technique.	
Course (Paper) Name and No.- **Minor- Advanced Chemistry-II**		
CO1	Differentiate between thermal and photochemical processes and also transition elements and coordination compounds.	
CO2	Explain various aspects Molecular Spectroscopy and Atomic Spectroscopy	
CO3	Describe spectroscopic methods of analysis	
CO4	Explain various aspects of heterocyclic chemistry	
Course (Paper) Name and **No.- Minor- Advanced Chemistry-II Practical**		
CO1	Determine molecular weight by Rast method and order of reaction by fractional change method and Explain the adsorption phenomenon and the validity of adsorption isotherm and Demonstrate practical skills based on instruments such as conductometry, pH meter, potentiometry.	
CO2	Demonstrate laboratory skills in combined aspects of organic/inorganic	

	analysis and Apply analytical skill for analysing real-world samples.	
CO3	Develop the practical skills for preparation of different inorganic metal complexes and Examine the percentage purity of the inorganic compounds qualitativelyand quantitively and impurity identification.	
CO4	Demonstrate the separation of the liquid-liquid and solid-liquid mixtures by distillation and Apply skills in the separation and qualitative analysis of organic compounds of liquid-liquid and Liquid-solid mixtures by micro-scale technique.	
Course (Paper) Name and No: **Medicinal and Colour Chemistry Elective-1**		
CO1	Explain details about the chemotherapeutic agents used for the treatment of different diseases side effects and synthesis.	
CO2	Explain drug discovery design and development and drug metabolism and application of nanoparticles in medicinal chemistry.	
CO3	Classify the dyes based on Chemical Constitution and preparations	
CO4	Explain the non-textile uses of the dyes.	
Course (Paper) Name and No: **Agrochemicals and Polymers Elective-2**		
CO1	Explain the structure and synthesis of Agrochemicals, Amino acids & Proteins	
CO2	Describe the catalysts and reagents with respect to functional group transformations and selectivity	
CO3	Explain the synthesis and applications of Polymers.	
Course (Paper) Name and No --**Practical's of Elective**		
CO1	To develop hands-on skills in drug synthesis, dosage form preparation, and pharmacological testing, gaining practical experience in drug formulation and analysis.	
CO2	To acquire proficiency in dyeing techniques, understanding the properties of natural and synthetic dyes, and applying them to different substrates for various textile applications.	
	Course (Paper) Name and No –On Job Training (OJT)	

	structure determination of organic compounds

Course Outcomes

Semester I M.Sc. Part-I Chemistry

Course (Paper) Name and No.- **Organic Chemistry paper-III**		
CO1	Understand the types of addition reaction and their applications.	
CO2	Summarize the various aspects of aromaticity, aliphatic and aromatic nucleophilic substitution reactions with their mechanism and examples.	
CO3	Apply the concept of Configurational descriptors (R,S nomenclature) to chiral centers in Organic compounds	
CO4	Predict the mechanism, selectivity, importance and applications of oxidizing and reducing agent.	
Course (Paper) Name and No.- **Organic Chemistry Practical**		
CO1	Plan preparation of organic compounds	
CO2	Demonstrate the skill of purification of organic compounds by recrystallization and sublimation methods.	
CO3	Apply the thin layer chromatography technique to check the purity of the synthesized product.	
CO4	Can Sketch the structure of organic compounds using software Chem Biodraw.	
Course (Paper) Name and No.- **Analytical Chemistry**		
CO1	Explain the concept of data domain, performance characteristics of an instrument/method, total quality management, quality standards for laboratories, quality audits and quality reviews.	
CO2	Discover the applications of UV-Visible spectroscopy, IR spectroscopy, Differential scanning calorimetry.	
CO3	Identify the need of automation in chemical analysis, safety measures in laboratory, need of accreditation of laboratories and GLP.	
CO4	Interpret the data based on calculations and statistical tests.	
Course (Paper) Name and No.- **Analytical Chemistry Practical**		
CO1	Demonstrate the titration skills for the analysis of samples of a diverse variety	
CO2	Apply the statistical methods for data analysis	
CO3	Analyze the measured data based on Chemical principles	
CO4	Measure the characteristics of ion exchange resins	
Course (Paper) Name and No.- **Inorganic Chemistry, Paper-1**		
CO1	Explain theories of bonding, hybridization, resonance concept, MOT for diatomic species of first transition Series, Polyatomic species and Higher boranes, carboranes, metalloboranes and metallocarboranes, metal carbonyls and halide clusters.	
CO2	Explain The concept of band theory, Fermi level, K-Space and Brillouin Zones. Structures of Compounds of the type: AB, AB2 etc. and Preparative methods of inorganic solids & nano materials.	
CO3	Construct Group Multiplication Tables, Character tables using concept of Molecular Symmetry and Group Theory.	
CO4	Determine electronic parameters such as Δ, B, C, Nephelauxetic ratio, formation constants of metal complexes and Characterize coordination compounds using techniques like thermal studies, Conductivity measurements, electronic spectral and magnetic measurements, IR, NMR and ESR spectroscopic	

Course (Paper) Name and No.- **Inorganic Chemistry Practical**		
CO1	Prepare various inorganic complexes such as Bis-(tetramethylammonium) tetrachloroCuprate (II) (Me4 N) 2[CuCl4],Tetramminemonocarbanato Cobalt (III) Nitrate, Bis (ethylenediammine) Copper (II) Sulphate, Hydroniumdichlorobis(dimethylglyoximato) etc.	
CO2	Determine the electrolytic nature of inorganic compounds	
CO3	Apply Slope intercept method for determination of equilibrium constants forFe^{+3}/ SCN- system.	
CO4	Analyze the inorganic complex for percentage of metal and ligand.	
Course (Paper) Name and No.- **Physical Chemistry (Electives-I)**		
CO1	Prove Maxwell relations and its significance and applications to ideal gases, Joule Thomson experiment, Joule Thomson coefficient and inversion temperature. Apply Third law of Thermodynamics to find out absolute entropy	
CO2	Make use of quantum mechanics for Particle waves and Schrödinger wave equation, wave functions, properties of wave functions, Normalization of wave functions, orthogonality of wave functions. Particle in a one, two- and three-dimensional box	
Course (Paper) Name and No.- **Physical Chemistry (Electives-II)**		
CO1	Define, understand basic terms of Chemical Dynamics i.e. rate constant, order of reaction, molecularity of reaction also compare Composite Reactions and Polymerization reactions	
CO2	Make use of Colloids and Surface Phenomena in daily applications	
Course (Paper) Name and No.- **Physical Chemistry Practical**		
CO1	Know the principles of different instruments like Potentiometry, Conductometry, pH Metry.	
CO2	Determine the heat of solution of sparingly soluble acid and identify the reaction between acetone and iodine.	
Course (Paper) Name and No.- **Research Methodology Minor**		
CO1	Explain the importance of different types of print and digital resources for gap analysis and data collection.	
CO2	Design/propose methodologies preferably with green and safe approach to conduct research	
CO3	Anayze scientific data by statistical and graphical methods.	
CO4	Apply skills of chemical safety & ethical handling of chemicals	
Semester II M.Sc. Part-I Chemistry		
Course (Paper) Name and No.- **Organic Chemistry**		
CO1	Explain the Generation of carbanion, enolate, and enamine with their alkylation & acylation reaction and name reactions with their mechanism.	
CO2	Illustrate mechanism, stereochemistry, applications and importance of name reactions and rearrangements.	
CO3	Explain the role of reagents in organic synthesis and understand the elimination reactions.	
CO4	Interpret the structure of organic compounds using combined of spectral techniques.	
Course (Paper) Name and No.- **Organic Chemistry Practical**		
CO1	Identify the chemical type of components present in a binary mixture of an organic compound.	
CO2	Apply skills in the separation and qualitative analysis of organic compounds of binary mixtures by microscale technique.	

CO3	Make use of crystallization, sublimation and distillation for purification of the organic compounds.	
CO4	Demonstrate the practical aspects in the preparation of the organic compounds' derivatives.	
Course (Paper) Name and No.- **Analytical Chemistry**		
CO1	Translate the theoretical principles of advanced separation techniques, spectroscopic techniques, radioanalytical techniques, electroanalytical techniques into applications.	
CO2	Explain the working principles of surface analytical techniques such as SEM, STM, TEM, ESCA, Auger spectroscopy and ICP-AES	
CO3	Compare the different ion sources and mass analyzers in mass spectroscopy	
CO4	Determine the electrical quantities such as charge, current, potential using Electroanalytical methods	
Course (Paper) Name and No.- **Analytical Chemistry Practical**		
CO1	Demonstrate the operational skills on the selected instruments and retrieve information	
CO2	Develop a sense of time management, safe use of chemicals and environmental safety	
Course (Paper) Name and No.- **Inorganic Chemistry**		
CO1	Recall Organometallic Chemistry of Transition metals, Eighteenand sixteen electron rules, Preparation and property's structure and bonding of the Organometallic compounds	
CO2	Explain Photochemical Reactions, Ligand substitution reactions of: Octahedral complexes, Square planar complexes, trans-effect, its theories and applications. Redox reactions: inner and outer sphere mechanisms, stereochemistry of substitution reactions of octahedral complexes	
CO3	Explain Bioinorganic Chemistry related to biological oxygen carriers; hemoglobin, hemerythrin and hemocyanin- structure of metal active center and differences in mechanism of oxygen binding, Copper containing enzymes, Nitrogen fixation Metal ion transport and storage, Medicinal applications of cis-platin and related compounds.	
CO4	Discuss the implication of toxic metallic species radioactive materials on environment and biological system using case studies.	
Course (Paper) Name and No.- **Inorganic Chemistry Practical**		
CO1	Analyse ores and alloys using volumetric and gravimetric analysis.	
CO2	Estimate percentage of metals in the ore and alloy.	
CO3	Apply the potentiometric method for redox titrations of Fe, Cu etc.	
Course (Paper) Name and No.- **Physical Chemistry (Electives-I)**		
CO1	Explain Bioenergetics, Real solutions and Fugacity of real gases also show graphical representations of BET isotherms	
CO2	Prove expressions for the total wave function for 1s,2s, 2p and 3d orbitals of hydrogen and aapplication of the Schrödinger equation to two electron system	
Course (Paper) Name and No.- **Physical Chemistry (Electives-II)**		
CO1	Explain terms involved in Chemical Kinetics and Molecular Reaction Dynamics. Elementary Reactions in Solution, Kinetics of reactions catalysed by enzymes -Michaelis-Menten analysis, Lineweaver-Burk and Eadie Analyses, Inhibition of Enzyme action.	
CO2	Apply Photochemistry to solve NET, SET GATE Problems.	
Course (Paper) Name and No.- **Physical Chemistry Practical**		

CO1	Know principles of different instruments like Potentiometry, Conductometry, pH Metry and colorimeter.	
CO2	Make use of graphical representation to identify Shape of Orbitals.	
Course (Paper) Name and No.- **On Job Training**		
CO1	Practical Skill Development: Trainees will acquire hands-on experience and proficiency in relevant industry tools, techniques, and processes, effectively applying theoretical knowledge to real-world tasks.	
CO2	Problem-Solving Abilities: Trainees will develop critical thinking and problem-solving skills by addressing practical challenges and troubleshooting issues encountered in the work environment.	
CO3	Professional Competency: Trainees will demonstrate enhanced job readiness and professional competency, including adherence to industry standards, effective communication, and teamwork	
CO4	Industry Knowledge: Trainees will gain a deeper understanding of industry practices, workflows, and organizational culture, improving their ability to navigate and contribute effectively within their field.	
CO5	Performance Improvement: Trainees will improve their performance and productivity by integrating feedback and learning from experienced professionals, leading to better job performance and career growth.	

M.Sc. Part-II Organic Chemistry

Programme Specific Outcomes

PSOs No.	**After completing the programme in M.Sc. Organic Chemistry, Student will able to:**	**Graduate Attribute**
PSO1	Develop analytical thinking and apply the same for understanding principles, proposing mechanism and logical conclusions, understanding of the interdisciplinary nature of Chemistry and emerging trends in Chemistry.	Disciplinary knowledge Problem solving
PSO2	Get research opportunities in academics as well as employment at R & D in synthetic division of chemical, pharmaceutical, dyestuff and food industries	Research skills
PSO3	Competency in design and planning of synthesis and carry out with Good Laboratory Practices, handling instruments and interpretation of spectral data for structure determination of organic compounds	Research skills

Course Outcomes

Semester III

Course (Paper) Name and No.- **Theoretical Organic Chemistry-I, Paper I**

CO1	Explain the structure, generation, stability and reactions of organic reactive intermediates and importance of neighbouring group participation, role of FMOs.	
CO2	Apply the principles of photochemistry to carbonyl compounds, olefins, arenes and radical reactions.	
CO3	Identify pericyclic reactions and describe cycloadditionreactions, electrocylic reactions and sigmatropic rearrangements	
CO4	Analyze conformation of medium size ring, fused ring, bridge ring, steroids and reactivity of addition, elimination, rearrangement and reduction with stereoselective and stereospecific reactions.	

Course (Paper) Name and No.- **Synthetic Organic Chemistry –I, Paper II**		
CO1	Summarize generation, stability, structure, stereochemical aspects of free radicals, its characteristic reactions and use in organic synthesis.	
CO2	Explain preparation of organometallic compound, its applications, mechanism and regiochemistry of reactions involving metals/non-metals in organic synthesis.	
CO3	Compare between enamines and enolates, methods of preparation, applications with stereochemical aspects in synthetic reactions	
CO4	Predict the products of name reactions, domino reactions, click reactions, multicomponent reactions and describe the mechanisms showing how the products are formed	
Course (Paper) Name and No.- **Natural products Heterocyclic chemistry and Spectroscopy-I, Paper III**		
CO1	Explain the occurrence, structural features, and biological importance and multistep synthesis of natural products.	
CO2	Draw conclusion based on evidence for structure elucidation and synthesis of natural products.	
CO3	Construct the names of heterocyclic compounds by IUPAC nomenclature and explain synthesis and reactivity of heterocyclic compounds	
CO4	Interpret the data for the structure elucidation of organic compounds based on UV, IR, ^{1}H-NMR and ^{13}C-NMR.	
Course (Paper) Name and No.- **Practicals in Organic Chemistry Major- IV**		
CO1	Plan the synthesis of organic compounds.	
CO2	Make use of thin layer chromatography and physical constant to know the purity of organic compounds	
CO3	Apply principles of purification techniques such as recrystallization and distillation for purification of organic compounds.	
CO4	Compare spectral data of reactant and product and explain mechanism of reactions and MSDS of chemicals.	
Course (Paper) Name and No.- **Drug Discovery, Design, Development and Synthesis Elective-I**		
CO1	Explain the basic terms used in medicinal chemistry, the pharmacokinetics of drug, drug structure activity relationship, physical chemical parameters of drugs and procedures in drug design.	
CO2	Apply skills required for drug design, development of modern methods of synthesis required for employment in the pharmaceutical industries.	
Course (Paper) Name and No.- **Biomolecules-I Elective-II**		
CO1	Identify the chemical type of components present the in ternary mixture of organic compounds.	
CO2	Apply skills in detection, identification and separation of organic compounds of ternary mixtures by microscale technique.	
Course (Paper) Name and No.- **Single step preparation and purification Elective-I/ Elective-II**		
CO1	Demonstrate the skills in organic preparations required for pursuing a career in the pharmaceutical, chemical industry, research etc.	
CO2	Make use of column chromatography, crystallization steam and vacuum distillation for purification of the organic compounds	
CO3	Identify the prepared organic compounds by Thin Layer Chromatography	
Course (Paper) Name and No.- **Research Project**		

Semester IV **M.Sc. Part-II Organic Chemistry Semester IV**		
Course (Paper) Name and No.- **Theoretical Organic Chemistry-II, Paper I**		
CO1	Explain the principles of molecular association and organization, host-guest interaction, structure and properties of crown ether, cryptands, cyclophanes, rotaxanes, cyclodextrines, molecular self-assembly and Supramolecular polymers	
CO2	Explain principles, methods of asymmetric synthesis and use of chiral auxiliaries in asymmetric synthesis	
CO3	Apply the linear free energy relationship for determination of organic reaction mechanism using Hammett equation and Taft equation.	
CO4	Determine the enantiomer and diastereomer composition by different methods, asymmetric transformation, molecular dissymmetry and chiroptical properties and explain the ORD and CD curves, Cotton effects, octane rule and its applications.	
Course (Paper) Name and No.- **Synthetic Organic Chemistry –II, Paper II**		
CO1	Explain the concepts of retrosynthesis, protecting groups, synthetic planning and selective transformations in organic synthesis.	
CO2	Apply disconnection approach, FGI, FGA, FGR and recognize starting compounds in designing organic synthesis of target molecules.	
CO3	Summarize electro-organic chemistry and use of organocatalyst, Lewis acid, crown ethers, cryptands, micelles etc. in selected methods of organic synthesis.	
CO4	Predict the products of organic synthesis in which transition and rare earth metals are used.	
Course (Paper) Name and No.- **Natural products Heterocyclic chemistry and Spectroscopy-II, Paper III**		
CO1	Explain occurrence, classification, structural and stereochemical features of steroids, insect pheromones, insecticides, vitamins and their biological role in life related processes.	
CO2	Plan the synthesis of biologically important steroids, vitamins, antibiotics, insecticides.	
CO3	Apply fundamentals of heterocyclic reactivity and synthesis skills required for heterocyclic compounds in research and industry and explain the names of heterocyclic compounds by IUPAC nomenclature and replacement nomenclature.	
CO4	Interpret the data for the structure elucidation of organic compounds based on UV, IR, ^{1}H-NMR, ^{13}C-NMR two dimensional spectroscopic techniques, COSY and HETCOR spectra, NOE and NOESY, INEPT, APT and INADEQUATE techniques.	
Course (Paper) Name and No.- **Green Chemistry Elective-I**		
CO1	Demonstrate the knowledge of the twelve principles of green Chemistry and importance of green chemistry which they can practice to a range of workplace for a safer less toxic and healthier environment.	
CO2	Apply the principles of green chemistry for synthesis	
Course (Paper) Name and No.- **Intellectual Property Rights Elective-II**		
CO1	Define various terminologies related to IPR	
CO2	Explain the role of law in the violation of IPR	
Course (Paper) Name and No.- **Separation of Ternary mixture and Spectral analysis Elective-I/ Elective-II**		
CO1	Identify the chemical type of components present the in ternary mixture of organic compounds.	

CO2	Apply skills in separation of organic compounds of ternary mixtures by micro scale technique.	
CO3	Compare spectral data of reactant and product and explain mechanism of reactions and MSDS of chemicals.	
CO4	Interpret spectral data like FT-IR, ^{13}C NMR, $^{1}HNMR$, UV-Visible spectrum and Mass spectrum for structure elucidation of organic compound	
Course (Paper) Name and No.- **Research Project**		

M.Sc.-II -Analytical Chemistry

Programme Specific Outcomes	
PSO1	Students will have a strong foundation in the fundamentals and application of various theoretical concepts in Analytical, Inorganic, Organic and Physical Chemistry
PSO2	Students will learn advanced characterization techniques by gaining the knowledge of spectroscopy, chromatography, electroanalytical methods, hyphenated techniques and chemistry of synthetic and natural products
PSO3	Student will learn the usage of analytical instruments, select, and apply appropriate techniques and resources for the analysis
PSO4	Students will demonstrate their laboratory skills in qualitative, quantitative, separation and advanced instrumental methods
PSO5	Students will identify the need of IPR by integrating the knowledge of total quality management, GLP and GMP
PSO6	Research ability will be developed as the students get skilled to problem solving, critical thinking and analytical reasoning as applied to scientific problems
PSO7	The ability to communicate scientific information in written, oral and electronic formats will be developed among students
PSO8	Students will be able to learn application of various softwares for interpretation and representation of results.

Course Outcomes M.Sc. Part-II Analytical Chemistry Semester III		
Course (Paper) Name and No.- **Quality in Analytical Chemistry Major-I**		
CO1	The importance of GLP and their regulations	
CO2	The theoretical aspects of sampling, pre-treatment and method validatio	
CO3	The laboratory accreditation, its benefits and importance of ICH guidelines.	
CO4	Measure the uncertainty in measurements, dealing with signal to noise ratio and legislator aspects of pharmaceutical industries	
Course (Paper) Name and No.- **Advanced analytical techniques Major-II**		
CO1	Study the of principle, instrumentation and applications of NMR spectroscopy.	
CO2	Study the detail concept of mass spectroscopy and Raman spectroscopy.	
CO3	Get detailed insights of advanced electroanalytical techniques.	
CO4	Find the applications of chemiluminescence, ORD- CD, Photoacoustic spectroscopy in analytical chemistry.	
Course (Paper) Name and No.- **Bioanalytical Chemistry and Food Analysis Major-III**		
CO1	Study bioanalytical techniques of analysis.	

CO2	The importance of Immunoassays and its applications.	
CO3	General idea about food processing, food preservation and determination of food contaminant etc.	
CO4	The technique used in food packaging and food analysis.	
Course (Paper) Name and No.- **Practical in Analytical Chemistry -I Major-IV**		
CO1	Understand the types of addition reaction and their applications	
CO2	Study graphical representation of the data.	
CO3	Knowledge of quality control methods and understand the importance of accuracy.	
Course (Paper) Name and No.- **Pharmaceutical Analysis Elective-I**		
CO1	The pharmaceutical analysis and quality control methods of pharmaceutical industry.	
CO2	The details of drug analysis on the basis of functional groups and other factors.	
Course (Paper) Name and No**.- Forensic and Cosmetics Analysis Elective-II**		
CO1	The applications of analytical chemistry in forensic science.	
CO2	The various aspects of cosmetic industry and analysis of different type cosmetics.	
	Course (Paper) Name and No.- **Research Project**	
Course Outcomes **M.Sc. Part-II Analytical Chemistry Semester IV**		
Course (Paper) Name and No**.-Separation Techniques Major-I**		
CO1	Insights of modern chromatographic techniques for separation on the basis of charge, size, and affinity of composition.	
CO2	Details of various separation processes.	
CO3	The separation, analysis and standardization of herbal based products.	
CO4	The concept of electrophoresis in analysis and Supercritical fluid Chromatography.	
Course (Paper) Name and No**.-Advanced Instrumental Technique Major-II**		
CO1	The theoretical concepts of surface analytical techniques. .	
CO2	Advanced spectroscopic techniques used for characterization of matter. .	
CO3	Principle and interfacing of radio analytical techniques and hyphenated thermal methods.	
CO4	The detail concept of hyphenated techniques including GC-MS, GC-IR, LC-MS, and HPLC-MS etc.	
Course (Paper) Name and No**.- Environmental Analysis and its Management Major-III**		
CO1	Various methods for solid waste management.	
CO2	The quality and requirement of potable water and bore well water.	
CO3	The importance of water quality and its monitoring.	
CO4	Different aspects of Chemistry of atmosphere and Environmental legislation.	
Course (Paper) Name and No**.- Intellectual Property Rights Elective I**		
CO1	Study about details of intellectual property.	
CO2	Study the intellectual property rights (IPR)	

CO3	Industrial designing and traits in it.	
Course (Paper) Name and No**.- Analysis of selected materials Elective II**		
CO1	Get idea about classifications and applications of plastics, polymers, paints and pigments and their environmental impact.	
CO2	The impact of plastic on environment as pollutant.	
CO3	The various metals, ferrous and non-ferrous alloys used in various industries.	
CO4	Study metallurgical analysis.	
Course (Paper) Name and No**.- Practical in Analytical Chemistry -I Elective Practical**		
CO1	Students will learn the analysis of quality of various types of samples using instrumental methods of analysis.	
CO2	Students will learn graphical representation of the data.	
CO3	Students will learn the various advanced analytical techniques for analysis of different samples.	
CO4	Students will get knowledge of quality control methods and understand the importance of accuracy.	
	Course (Paper) Name and No.- **Research Project**	