

**Department of Chemistry**  
**Rajeev Gandhi Govt . Post Graduate College Ambikapur**  
**Relevance of courses to Local /Regional/ National/ Global Needs during 2023-2024**

Class/Course Code	Course Title	Description	Relevance			
			Local	Regional	National	Global
M. Sc.I /MSC 101	INORGANIC CHEMISTRY-I	<ul style="list-style-type: none"> <li>• STEREOCHEMISTRY AND BONDING IN MAIN. GROUP COMPOUNDS</li> <li>• REACTION MECHANISM OF TRANSITION METAL COMPLEXES</li> <li>• METAL LIGAND BONDING</li> <li>• METAL COMPLEXES</li> </ul>		✓	✓	✓
M. Sc.I /MSC 102	ORGANIC CHEMISTRY -I	<ul style="list-style-type: none"> <li>. STEREOCHEMISTRY</li> <li>. CONFORMATIONAL ANALYSIS</li> <li>. ALIPHATIC NUCLEOPHILIC SUBSTITUTION REACTION AND ALIPHATIC ELECTROPHILIC SUBSTITUTION</li> <li>. AROMATIC ELECTROPHILIC SUBSTITUTION REACTIONS</li> <li>. AROMATIC NUCLEOPHILIC SUBSTITUTIONS AND</li> </ul>		✓	✓	✓
M. Sc.I /MSC 103	ANALYTICAL CHEMISTRY-1	<ul style="list-style-type: none"> <li>. FUNDAMENTALS OF CHEMICAL ANALYSIS</li> <li>. CHROMATOGRAPHY</li> <li>. ION EXCHANGE</li> <li>. SOLVENT EXTRACTION</li> <li>. SPECTROSCOPIC TECHNIQUES</li> </ul>	✓	✓	✓	✓
M. Sc.I /MSC 111	INORGANIC CHEMISTRY LAB.	<ul style="list-style-type: none"> <li>. QUALITATIVE ANALYSIS OF MIXTURE CONTAINING EIGHT RADICALS</li> <li>. QUANTATIVE ANALYSIS</li> <li>. ESTIMATION</li> </ul>	✓	✓	✓	
M. Sc.I /MSC 112	ANALYTICAL CHEMISTRY LAB	<ul style="list-style-type: none"> <li>. ERROR ANALYSIS&amp; STATISTICAL DATA ANALYSIS</li> <li>. VOLUMETRIC AND GRAVIMETRIC ANALYSIS</li> </ul>	✓	✓	✓	✓

		. CHROMATOGRAPHY . Ph METRY /POTENTIOMETRY . SPECTROPHOTOMETRY . NEPHELOMETRY/TURBIDIMETRY . APPLICATION OF COMPUTER IN CHEMISTRY				
M. Sc.I /MSC 104	SOCIAL OUTREACH,ENT ERPNEURSHI P & INTERSHIP		✓	✓	✓	
M. Sc.I /MSC 105	CONSTITUTIONA LISM & INDIAN POTITICAL SYSTEM	. CONSTITUTION . CONCEPT OF STATE AND CITIZENSHIP . UNION EXECUTIVE AND STATE EXECUTIVE . PARLIAMENT OF INDIA . INDIAN DEMOCRACY . CONTROLLER & ACCOUNTANT GENERAL OF INDIA	✓	✓	✓	
M. Sc.I /MSC 106	GROUP THEORY ,SPECTROSCOPY AND DIFFRACTION METHOD	. DIFFERACTION TECHNIQUES . GROUP THEORY . PHOTOELECTRON SPECTROSCOPY . NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY . ELECTRON SPIN RESONANCE SPECTROSCOPY			✓	✓
M. Sc.I /MSC 107	COMPUTER PROGRAMMING IN CHEMISTRY	. FUNDAMENTAL OF PROGRAMMING . INTRODUCTION TO C AND PROGRAMMING . NUMERICAL ANALYSIS . DEVELOPMENT OF SMALL COMPUTER CODE . INTRODUCTION AND USE OF COMPUTER PACKAGES				

M. Sc.I /MSC 108	MEDICINAL CHEMISTRY	.DRUG DESIGN .PHARMACOKINETICS . ANTINEOPLASTIC AGENT . DRUG SYNTHESIS . CARDIOVASCULAR DRUGS	✓	✓		✓
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Class/Course Code	Course Title	Description	Relevance			
			Local	Regional	National	Global
M. Sc.II/MSC 201	INORGANIC CHEMISTRY-2	. ELECTRONIC SPECTRA AND MAGNETIC PROPERTIES OF TRANSITION METAL COMPLEXES . METAL CLUSTURES . HOMOGENOUS AND HETEROGENOUS CATALYSIS BY ORGANOMETALLIC COMPOUND . BIOINORGANIC CHEMISTRY . COORDINATION CHEMMISTRY		✓		✓
M. Sc.II/MSC 202	ORGANIC CHEMISTRY -2	. ADDITION TO CARBON - CARBON AND CARBON - HETERO MULTIPLE BONDS . OXIDATIONS AND REDUCTIONS . MOLECULAR REARRANGEMENTS . NATURE OF BONDING AND REACTION MECHANISM .REACTION INTERMEDIATES	✓	✓		✓
M. Sc.II/MSC 203	PHYSICAL CHEMISTRY -2	. RECAPITULATION . RAMAN SPECTROSCOPY . ELECTRONIC SPECTROSCOPY OF MOLECULES . NEUTRON DIFFRACTION . ELECTRON DIFFERACTON . QUANTUM CHEMISTRY . SURFACE CHEMISTRY		✓		✓

M.Sc.II/MSC 211	ORGANIC CHEMISTRY LAB	. QUALITATIVE ANALYSIS -ORGANIC SYNTHESIS . QUANTITATIVE ANALYSIS	✓	✓		✓
M.Sc.II/MSC 212	PHYSICAL CHEMISTRY LAB	. ADSORPTION . CHEMICAL KINETICS . SOLUTION . CONDUCTOMETRY . POTENTIOMETRYS/pH METRY	✓	✓		✓
M.Sc.II/MSC 204	RESEARCH METHODOLOGY &COMPUTER	. CONCEPT OF RESEARCH . TOOLS OF RESEARCH . METHODS OF RESEARCH	✓	✓		✓
	APPLICATION	. TREATMENT OF DATA . COMPUTER FUNDAMENTALS . OPERATING SYSTEM . OFFICE SOFTWARE PACKAGE				
M.Sc.II/MSC 205	ENVIRONMENTA L AND FOREST LAWS	. EVOLUTION OF FOREST AND WILD LIFE LAWS . FOREST PROTECTION AND LAW . WILDLIFE PROTECTION AND LAW . BASIC CONCEPTS . INTRODUCTION TO LEGAL SYSTEM . LEGISLATIVE FRAMEWORK FOR POLLUTION CONTROL LAWS . LEGISLATIVE FRAMEWORK FOR ENVIRONMENT PROTECTION . ENVIRONMENTAL CONSTITUTIONALISM	✓	✓		✓
M.Sc.II/MSC 206	POLYMER CHEMISTRY	. BASIC CONCEPTS . KINETICS AND MECHANISM . INDUSTRIAL NATURAL POLYMERS . SPECIALITY POLYMERS	✓	✓		✓
M.Sc.II/MSC 207	V (ORGANIC SYNTHESIS-I)	. MODERN SYNTHETIC METHODS, REACTIONS AND REAGENTS . NUCLEOPHILIC C-C BOND FORMATION		✓		✓

		<ul style="list-style-type: none"> <li>. ELECTROPHILIC C-C BOND FORMATION</li> <li>. MISCELLANEOUS REACTIONS</li> <li>. REAGENTS IN ORGANIC SYNTHESIS</li> </ul>				
M.Sc.II/MSC 208	V (APPLIED CHEMISTRY)	<ul style="list-style-type: none"> <li>. CHEMISTRY OF WATER</li> <li>. CHEMISTRY OF DRUGS</li> <li>. CHEMISTRY OF POLYMERS</li> <li>. CHEMISTRY OF MATERIALS</li> <li>. CHEMISTRY OF ENVIRONMENTAL POLLUTANTS</li> </ul>	✓	✓		
Class/Course Code	Course Title	Description	Relevance			
			Local	Regional	National	Global
M.Sc.III/MSC 301	APPLICATION OF SPECTROSCOPY - INORGANIC CHEMISTRY	<ul style="list-style-type: none"> <li>. APPLICATIONS OF ATOMIC ABSORPTION SPECTROSCOPY</li> <li>. VIBRATIONAL SPECTROSCOPY SYMMETRY AND</li> </ul>	✓	✓		✓
		SHAPES <ul style="list-style-type: none"> <li>. ELECTRON SPIN RESONANCE SPECTROSCOPY HYPERFINE COUPLING</li> <li>. ELECTRONIC SPECTROSCOPY</li> <li>. MOSSBAUER SPECTROSCOPY BASIC PRINCIPLES</li> </ul>				
M.Sc.III/MSC 302	APPLICATION OF SPECTROSCOPY - ORGANIC CHEMISTRY	<ul style="list-style-type: none"> <li>. ULTRAVIOLET AND VISIBLE SPECTROSCOPY VARIOUS ELECTRONIC TRANSITIONS (185-800 nm)</li> <li>. MASS SPECTROSCOPY</li> <li>. INFRARED SPECTROSCOPY INSTRUMENTATION AND SAMPLE HANDLING</li> <li>. NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY GENERAL INTRODUCTION AND DEFINITION</li> <li>. SIMPLIFICATION OF COMPLEX SPECTRA-NUCLEAR MAGNETIC DOUBLE RESONANCE</li> </ul>	✓	✓		✓
M.Sc.III/MSC 303	PHOTOCHEMIST RY	<ul style="list-style-type: none"> <li>. PHOTOCHEMISTRY</li> <li>. INTERACTION OF ELECTROMAGNETIC RADIATION WITH MATTER</li> <li>. DERERMINATION OF REACTION MECHANISM</li> <li>. PHOTOCHEMISTRY OF ALKENES</li> <li>. PHOTOCHEMISTRY OF CARBONYL COMPOUNDS</li> </ul>		✓		✓

M.Sc.III/MSC 311	GENERAL CHEMISTRY LAB	<ul style="list-style-type: none"> <li>. INSTRUMENTAL METHODS AND ANALYTICAL TECHNIQUES</li> <li>A. SPECTROPHOTOMETRIC DETERMINATIONS</li> <li>. B. PH METRY</li> <li>C. POLAROGRAPHY</li> <li>D. FLAME PHOTOMETRIC DETERMINATIONS</li> <li>E. NEPHELOMETRIC DETERMINATIONS</li> <li>F. SEPARATION AND QUANTITATIVE ESTIMATION OF BINARY AND TERNARY MIXTURES BY THE USE OF THE FOLLOWING SEPARATION TECHNIQUES</li> <li>SECTION –B [ ORGANIC CHEMISTRY</li> <li>A. QUANTITATIVE ORGANIC ANALYSIS</li> <li>B. FUNCTIONAL GROUP ESTIMATION</li> <li>SECTION- C [PHYSICAL AND ANALYTICAL CHEMISTRY]</li> <li>PHYSICAL CHEMISTRY:</li> <li>E. CONDUCTOMETRY</li> <li>F. COLORIMETRY</li> <li>G. PH METRY</li> <li>H. POTENTIOMETRY</li> <li>E. DISTRIBUTION COEFFICIENT</li> <li>F. PARTIAL MOLAR VOLUME</li> <li>ANALYTICAL CHEMISTRY</li> </ul>	✓	✓		✓
M.Sc.III/MSC 304	INTELLECTUAL PROPERTY LAW	<ul style="list-style-type: none"> <li>. INTRODUCTION,NATURE,BASIC CONCEPTS AND INTERNATIONAL CONVENTION</li> <li>. LAW OF COPYRIGHT</li> <li>. LAW OF PATENTS</li> <li>. LAW OF TRADEMARK</li> <li>. DESIGN AND OTHER FORM OF GEOGRAPHICAL INDICATION (GI)</li> </ul>	✓	✓		✓
M.Sc.III/MSC 305	TRIBAL STUDIES	<ul style="list-style-type: none"> <li>. TRIBAL STUDIES</li> <li>. SCHEDULED TRIBE IN INDIA</li> <li>. SOME MAJOR TRIBES IN INDIA</li> <li>. SOME MAJOR TRIBES IN CENTRAL INDIA</li> <li>. ILITERACY</li> <li>. PROBLEM OF HEALTH AND SANITATION</li> <li>WELFARE-CONCEPT, CHARACTERISTICS</li> <li>TRIBAL DEVELOPMENT PROGRAMS FOR SCHEDULED TRIBES</li> <li>. TRIBAL WELFARE &amp; ADVISORY AGENCIES IN INDIA</li> </ul>	✓	✓		
M.Sc.III/MSC 306	GREEN CHEMISTRY	<ul style="list-style-type: none"> <li>. PRINCIPLES &amp; CONCEPT OF GREEN CHEMISTRY</li> <li>. MEASURING AND CONTROLLING ENVIRONMENTAL PERFORMANCE</li> <li>. EMERGING GREEN TECHNOLOGY AND ALTERNATIVE ENERGY SOURCES</li> <li>. RENEWABLE RESOURCES</li> <li>. INDUSTRIAL CASE STUDIES</li> </ul>	✓	✓		✓

M.Sc.III/MSC 307	ORGANIC SYNTHESIS II	. DISCONNECTION APPROACH . PROTECTING GROUPS PRINCIPLE OF PROTECTION OF ALCOHOL . TWO GROUP C-C DISCONNECTIONS . RING SYNTHESIS . SYNTHESIS OF SOME COMPLEX MOLECULES		✓		✓
M.Sc.III/MSC 308	HETEROCYCLIC CHEMISTRY	. NOMENCLATURE OF HETEROCYCLES . NON-AROMATIC HETEROCYCLES . SMALL RING HETEROCYCLES . MESO-IONIC HETEROCYCLES . HIGHER HETEROCYCLES		✓		✓

Class/Course Code	Course Title		Local	Regional	National	Global	
M.Sc.IV/MSC 401	BIOINORGANIC CHEMISTRY	. METAL IONS IN BIOLOGICAL SYSTEM . RESPIRATORY PROTEINS . METALLOENZYMES (REDOX AND NON REDOX) / METAL ION TRANSPORT AND STORAGE . NITROGENASE ENZYME		✓	✓	✓	

		. MEDICINAL BIO-INORGANIC CHEMISTRY/CHELATION THERAPY				
M.Sc.IV/MSC 402	ENVIRONMENTAL CHEMISTRY	. ATMOSPHERIC CHEMISTRY . THE EARTH ;THE LITHOSPHERE . THE BIOSPHERE . POLLUTION CONTROL	✓	✓	✓	
M.Sc.IV/MSC 403	SOLID STATE CHEMISTRY	. SOLID STATE REACTION . ELECTRONIC PROPERTIES AND BAND THEORY . ORGANIC SOLID . LIQUID CRYSTALS . THE CRYSTAL LATTICE . BONDING IN SOLIDS		✓	✓	
M.Sc.IV/MSC 411	ORGANIC CHEMISTRY LAB	. SECTION- A A. MULTI-STEP SYNTHESIS OF ORGANIC COMPOUNDS . SECTION –B B. EXTRACTION OF ORGANIC COMPOUND FROM NATURAL SOURCE C. SPECTROSCOPY D. SPECTROPHOTOMETERIC ESTIMATIONS SECTION-C 1. ESTIMATIOIS : ANY ONE OF THE FOLLOWING ESTIMATION 2. PREPARATION OF DYES –	✓	✓	✓	
M.Sc.IV/MSC 404	DISSERTATION					
M.Sc.IV/MSC 405	PHOTO INORGANIC CHEMISTRY	. BASICS OF PHOTOCHEMISTRY . PROPERTIES OF EXCITED STATES . LIGAND FIELD PHOTOCHEMISTRY . REDOX REACTIONS BY EXCITED METAL COMPLEXES . METAL COMPLEX SENSITIZERS	✓	✓	✓	



M.Sc.IV/MSC 406	MATERIAL SCIENCE	. CLASSIFICATION OF CRYSTALS . CRYSTAL GEOMETRY . THEORIES OF METALLIC STATE . IONIC CONDUCTORS . ORGANIC SEMICONDUCTORS		✓	✓	
M.Sc.IV/MSC 407	CHEMISTRY OF NATURAL PRODUCTS	. TERPENOID AND CAROTENOIDS . STEROIDS . PLANT PIGMENTS . PORPHYRINS . PROSTGLANDIS	✓	✓	✓	

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**Relevance of courses to Local /Regional/ National/ Global Needs during 2023-2024**

Course Code		Course Title	Description	Relevance			
				Global	National	Regional	Local
B. Sc. I	Unit-I	Atomic Structure and periodic Properties	Bohr's theory, its limitation and atomic spectrum of hydrogen atom. General idea of de-Broglie matter-waves, Heisenberg uncertainty principle, Detailed discussion of the following periodic properties of the elements, with reference to s and p-block. Trends in periodic table.	✓	✓	✓	✓
	Unit-II	Chemical Bonding-I, II	Ionic bond: Ionic Solids - Ionic structures, radius ratio & co-ordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy Born-Haber cycle, Covalent bond: Lewis structure, Valence bond theory and its limitations, Concept of hybridization, Energetics of hybridization, equivalent and non-equivalent hybrid orbitals.	✓	✓	✓	✓
	Unit-III	Basics of Organic Chemistry	Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment.	✓	✓	✓	✓
	Unit-IV	Stereochemistry and Conformational analysis	Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Diastereoisomers, meso compounds, Relative and absolute configuration,	✓	✓	✓	✓

			Conformational analysis of alkanes, ethane, butane, cyclohexane and sugars.				
	Unit-V	Mathematical concept and Gaseous state chemistry	Basic Mathematical Concepts: Logarithmic relations, curve sketching, linear graphs, Properties of straight line, slope and intercept, Functions, Differentiation of functions, Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path; Maxwell distribution	✓	✓	✓	
B. Sc.- II	Unit-I	s-, p-Block elements, Noble gases and qualitative analysis	General concepts on group relationships and gradation properties, Comparative study, salient features of hydrides, solvation & complexation tendencies including their function in biosystems and introduction to alkyl and aryl derivatives .properties of halides nobel gases.	✓	✓	✓	✓
	Unit-II	Chemistry of aliphatic hydrocarbons	Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reaction, Free radical substitutions: Halogenation-relative reactivity and selectivity. Reactions of alkenes: Electrophilic additions and mechanisms (Markownikoff/ Anti - Markownikoff addition), mechanism of oxymercuration-demercuration, hydroboration- oxidation,	✓	✓	✓	✓
	Unit-III	Aromatic hydrocarbons	Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/ carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directive effects of the groups.	✓	✓	✓	
	Unit-IV	Liquid & Solid State, Colloid and surface Chemistry	Intermolecular forces, magnitude of intermolecular force, structure of liquids, Properties of liquids, viscosity and surface tension. Gold number, Emulsion, micelles and types, Gel, Syneresis and thixotrophy, Application of colloids. Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations,	✓	✓	✓	✓

	Unit-V	Chemical Kinetics	Rate of reaction, Factors influencing rate of reaction, rate law, rate constant, Order and molecularity of reactions, rate determining step, Zero, First and Second order reactions, Homogeneous and Heterogeneous Catalysis, types of catalyst, characteristic of catalyst, Enzyme catalysed reactions, Micellar catalysed reactions, Industrial applications of Catalysis	✓	✓	✓	✓
B. Sc.- III	Unit-I	Chemistry of transition series elements	Transition Elements: Position in periodic table, electronic configuration, General Characteristics, viz., atomic and ionic radii, variable oxidation states, ability to form complexes, formation of coloured ions, magnetic moment $\mu_{so}$ (spin only) and $\mu_{eff}$ and catalytic behavior. Redox potential, electrochemical series and its applications, Principles involved in extraction of the elements.	✓	✓	✓	✓
	Unit-II	Coordination Chemistry	Werner's theory and its experimental verification, IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelates, polynuclear complexes. Valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory,	✓	✓	✓	
	Unit-III	Chemistry of organic halides	Alkyl halides: Methods of preparation, nucleophilic substitution reactions – SN1, SN2 and SN1 mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution, elimination reactions. Aryl halides, Benzyne mechanism Trihydric alcohols - Nomenclature, methods of formation, chemical reactions of glycerol.	✓	✓	✓	✓
	Unit-IV	Aldehydes and Ketones	Nomenclature, structure and reactivity of carbonyl group. General methods of preparation of aldehydes and ketones. Mechanism of nucleophilic addition to carbonyl groups: Benzoin, Aldol, Perkin and Knoevenagel condensation. Condensation with ammonia and its derivatives, Wittig reaction, Mannich reaction, Beckmann and Benzil- Benzilic rearrangement. Use of acetate as protecting group, Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones,	✓	✓	✓	

			Cannizzaro reaction,				
	Unit-v	Thermodynamics and Thermochemistry	Intensive and extensive variables; state and path functions; isolated, closed and open systems; Zeroth law of thermodynamics. calculations of q, w, U and H Second Carnot's theorem, thermodynamic state of temperature. Concept of entropy Thermochemistry, Laws of Thermochemistry, Heats of reactions, standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications.	✓	✓	✓	✓
B. Sc. -IV	Unit-I	Chemistry of lanthenides and Actinides	Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds. General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from uranium, similarities between the later actinides and the laterlanthanides.	✓			
	Unit-II	Acids Bases and Non Aqueous Solvents	Arrhenius, Bronsted-Lowry, conjugate acids and bases, relative strengths of acids and bases, the Lux-fllood, solvent system and Lewis concepts of acids and bases. A. Physical properties of a solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid ammonia and liquid sulphur dioxide, HF, H <sub>2</sub> SO <sub>4</sub> , Ionic liquids.	✓	✓	✓	✓
	Unit-III	Carboxylic acids and derivatives	Preparation, Structure and bonding, Physical and chemical properties including, acidity of carboxylic acids, effects of substituents on acid strength, Hell-Volhard Zeilinsky reaction. Reduction of carboxylic groups, Mechanism of decarboxylation. Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline medium. Reactivity, structure and nomenclature of amines, physical properties.	✓	✓	✓	
	Unit-IV	Chemical and Phase equilibrium	Criteria of thermodynamic equilibrium, Concept of Fugacity, Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction	✓	✓	✓	✓

			<p>quotient Coupling of exergonic and endergonic reactions.</p> <p>Equilibrium constants and their quantitative dependence on temperature, pressure and concentration.</p> <p>. Phase rule, Phase, component and degree of freedom, derivation of Gibbs phase rule, limitation of phase rule, applications of phase rule to one component system: Water system and sulphur system.</p>				
	Unit-V	Ionic Equilibria & Photochemistry	<p>Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono protic acids (exact treatment). Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications. Characteristics of electromagnetic radiation, Interaction of radiation with matter, difference between thermal and photochemical processes, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry.</p>	✓	✓	✓	
B.Sc.-V	Unit-I	Metal ligand binding in transition metal complexes	<p>(A) Limitations of valence bond theory, Limitation of Crystal Field Theory, Application of CFSE, tetragonal distortions from octahedral geometry, Jahn-Teller distortion, square planar geometry. Qualitative aspect of Ligand field and MO Theory. Thermodynamic and kinetic aspects of metal complexes. A brief outline of thermodynamic stability of metal complexes and factors affecting the stability</p>	✓	✓	✓	✓
	Unit-II	Magnetic properties of transition metal complexes	<p>Types of magnetic behavior, methods of determining magnetic susceptibility, spin only formula, L-S coupling, Electronic spectra of Transition Metal Complexes. Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectro-chemical series.</p>	✓	✓	✓	✓
	Unit-III	Heterocyclic compounds	<p>Classification and nomenclature, Structure, aromaticity in 5-membered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Organomagnesium compounds: Grignard</p>	✓	✓	✓	

			reagents formation, structure and chemical reactions.				
	Unit-IV	Biomolecules Carbohydrates, Amino Acids Synthetic polymers and dyes	Occurrence, classification and their biological importance. Monosaccharides: relative and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, polymerization, Ziegler-Natta polymerization, Colour and constitution (Electronic Concept). Classification of Dyes. Chemistry of dyes.	✓	✓	✓	✓
	Unit-V	Quantum mechanics	Black-body radiation, Planck's radiation law, photoelectric effect, Compton effect. Operator: Hamiltonian operator, angular momentum operator, Laplacian operator, postulate of quantum mechanics, eigen values, eigen function, Quantum Mechanical approach of Molecular orbital theory, basic ideas - criteria for forming M.O. and A.O., LCAO approximation	✓	✓	✓	
B.Sc.-VI	Unit-I	Organometallic Chemistry	Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. Metal carbonyls: 18-electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series. Alkene hydrogenation (Wilkinson's Catalyst) Polymerization of ethane using Ziegler - Natta Catalyst	✓	✓	✓	✓
	Unit-II	Bioinorganic Chemistry Hard and Soft acid Inorganic Polymers	Essential and trace elements in biological processes, Excess and deficiency of some trace metals, Toxicity of some metal ions (Hg, Pb, Cd and As), metalloporphyrins with special reference to hemoglobin and myoglobin. Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, Applications of HSAB principle. Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones. Silicates, phosphazenes and polyphosphate.	✓	✓	✓	✓
	Unit-III	Infrared, UV and NMR Spectroscopy	Basic principle, IR absorption Band their position and intensity, IR spectra of organic compounds Beer Lambert's	✓	✓		

			law, effect of Conjugation, Types of electronic transitions $\lambda_{\max}$ , chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption Visible spectrum and colour. Basic principles of Proton Magnetic Resonance, Tetramethyl silane (TMS) as internal standard, chemical shift and factors influencing it; Spin - Spin coupling and coupling constant(J).				
	Unit- IV	Spectroscopy	Characterization of Electromagnetic radiation, regions of the spectrum, representation of spectra, width and intensity of spectral transition, Rotational Spectrum of Diatomic molecules. Fundamental vibration and their symmetry vibrating diatomic molecules, Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, determination of force constant, anharmonic oscillator	✓	✓		

## DEPARTMENT OF CHEMISTRY

### PO-CO Mapping

#### Programme Out comes in B.Sc.(Hons.) Chemistry ( UG)

The B.Sc. programme in chemistry is designed to develop in students in depth knowledge of the core concepts and principles that are central to the understanding of this core science discipline. Undergraduates pursuing this programme of study go through laboratory work that specifically develops their qualitative skill, provides opportunities for critical thinking and team work, and exposes them to techniques useful for applied areas of scientific study.

**PO 1 : Critical Thinking :** Inculcate critical thinking to carry out scientific investigation objectively Formulate coherent arguments : Critically evaluate practices, policies and theories by following scientific approach to knowledge development .Critically evaluate ideas ,evidence from an open –minded and reasoned perspective.

**PO 2: Knowledge: Width and depth:** Students acquire theoretical knowledge and understanding of the fundamental concept, principals and processes in main branches of chemistry, namely, organic chemistry, inorganic chemistry, physical chemistry, analytical chemistry and bio chemistry. In depth understanding is the outcome of transactional effectiveness and treatment of specialized course contents . Width result from the choice of electives that students are offered.

**PO 3: Laboratory Skill :Quantitative**, analytical and instrument based : A much valued learning outcome of this programme is the laboratory skill that students develop during the course. Quantitative techniques gained through hand on methods open choice of joining the industrial laboratory work force early on. The programme also provides ample training in handling basic chemical laboratory instruments and their use in analytical and biochemical determination. Undergraduate on completion of this programme can cross branches to join analytical, pharmaceutical, material testing and biochemical labs besides standard chemical laboratories.

**PO 4:Communication:** Communication is a highly desirable attribute to possess. Opportunities to enhance students ability to write methodical , logical and precise reports are inherent to the structure of the programme. Techniques that effectively communication scientific chemical content to large audiences are acquired through oral and poster presentation and regular laboratory report writing.

**PO 5 : Capacity Enhancement :** Modern day scientific environment requires students to possess ability to think independently as well as be able to work productively in group. This requires some degree of balancing . The chemistry honours programme course is designed to take care of this important aspect of student development through effective teaching learning procee..

**PO 6: Portable Skill:** Besides communication skill, the programme develop s rsnge of portable or transferable skill in student that they can carry with them to their new work environment after completion of chemistry honours programme. These are problem solving. Numeracy and mathematical skill-error analysis, and conversion, information retrieval skill, It skill and organizational skill, these are valued across work environments.

**PO 7: Scientific Communication Skill :**Imbibe effective scientific and /or technical communication in both oral and writing .Ability to show the importance of the subject as precursor to various scientific development since the beginning of the civilization.

**PO 8 : Research Skill :** Prepare student for pursuing research or in industry in concerned subject and allied fields, Capability to use appropriate software to solve various problems.

## **PROGRAMME OUTCOME FOR B.SC. CERTIFICATE/ DIPLOMA/DEGREE COURSES**

**The students will be able to demonstrate ability –**

1. to understand concept and theory of their respective subject.
2. to express thoughts and ideas effectively in writing and orally.
3. to identify relationship within and across disciplines in the sciences.
4. to cognitive and technical skills in their field and in multidisciplinary context.
5. to select and use relevant methods and tools for problem solving .
6. to make judgment and take decisions, based on analysis of data and evidence.
7. to critically evaluate principles and theory of sciences .



8. in digital literacy and data analysis.
9. to find a job in their field, exercise responsibilities to job assigned and start-up a business .
10. to develop a sense of respect and duty towards constitutional, human and moral and professional values .
11. to mitigating the effects of environmental degradations, climate change and pollution.

### **Programme Specific Outcome**

After Successfully completion of Three Year degree program in chemistry a student will be able to:-

PSO1. Gain the knowledge of chemistry through theory and practicals.

PSO2. To explain nomenclature, stereochemistry structure, reactivity and mechanism of chemical reactions.

PSO3. Identify chemical formulae and solve numerical problems.

PSO4. Understand good laboratory practices and safety.

PSO5. Make aware and handle the sophisticated instruments/equipments.

## ACADEMIC PROGRAMME AND SCHEME

CLASS	COURSE TYPE	COURSE CODE	COURSE / PAPER	THEORY CREDIT/HRS.	PRACTICAL CREDIT/HRS
SEM-1	DSC-1	DSCCHE-01	ATOMIC STRUCTURE, BONDING FUNCTIONAL ORGANIC CHEMISTRY I	3/45	1/30
SEM-1	GE-I	GEICHE-01	FUNDAMENTAL CHEMISTRY (INORGANIC AND PHYSICAL CHEMISTRY)	3/45	1/30
SEM-II	DSC-2	DSCCHE-02	SOLUTION, EQUILIBRIA FUNCTIONAL ORGANIC CHEMISTRY-II	3/45	1/30
SEM-II	DSC-3	DSCCHE-03	CONDUCTANCE, ELECTRO CHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY II	3/45	1/30
SEM-III	DSE-1	DSEICHE-01	s, p, d, AND f BLOCK ELEMENT	3/45	1/30
SEM-IV	DSC-4	DSCCHE-04	CHEMICAL KINETICS, SURFACE CHEMISTRY AND THERMODYNAMICS	3/45	1/30
SEM-IV	DSE-2	DSEICHE-02	MOLECULES OF LIFE	3/45	1/30
SEM-V	DSC-5	DSEICHE-05	COORDINATION CHEMISTRY FUNCTIONAL GROUP ORGANIC CHEMISTRY IV	3/45	1/30
SEM-V	DSE-3	DSEICHE-03	ORGANOMETALLIC CHEMISTRY	3/45	1/30
SEM-VI	DSD-6	DSEICHE-06	QUANTUM CHEMISTRY & PHOTOCHEMISTRY	3/45	1/30
SEM-VI	DSE-4	DSEICHE-04	SOLID STATE AND MOLECULAR SPECTROSCOPY	3/45	1/30

## **B.Sc. CHEMISTRY (NEP) 2023-2024**

### **DEPARTMENT OF CHEMISTRY**

#### **B.Sc. Chemistry**

#### **Programme Outcomes :**

After Successfully completion of Three Year degree program in chemistry a student will be able to:-

- PO1. Demonstrate, solve and an understanding of major concepts in all disciplines of chemistry.
- PO2. Create an awareness of the impact of chemistry on the environment society and development outside the scientific community.
- PO3. Solve the problem and also think methodically independently and draw a logical conclusion.
- PO4. To inculcate the Scientific temperament in the student and outside the scientific community.
- PO5. Use modern techniques, descent equipments and chemical Softwares.

## Course Outcomes

### B.Sc. I Semester (Chemistry)

#### DSC-1 ATOMIC STRUCTURE, BONDING FUNCTIONAL ORGANIC CHEMISTRY I

After completion of course, the students will able to:-

- CO 1. Understand concept of hybridization and shape of molecules based on hybridization.
- CO 2. Explain the periodic properties.
- CO 3. Recall the structure of atom.
- CO 4. Explain the electron displacements and their effect on reactivity of organic molecules.
- CO 5. Understand the concept of stereochemistry.
- CO 6. Differentiate configuration and conformation.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO-1	✓	✓	✓	✓	✓	✓
PO-2	✓	✓		✓		
PO-3	✓	✓			✓	
PO-4	✓	✓		✓		
PO-5			✓			✓
PO-6		✓				
PO-7	✓	✓	✓	✓	✓	✓
PO-8						
PO-9	✓				✓	
PO-10						
PO-11						

## B.Sc.I Semester Course Outcome

### GE-I FUNDAMENTAL CHEMISTRY (INORGANIC AND PHYSICAL CHEMISTRY)

After completion of course, the students will be able to:-

CO1. To learn basic concept of atomic structure and the periodic properties of elements.

CO2. To understand about periodic table and periodicity in properties.

CO3. To Understand chemical bonding in covalent compound.

CO4. Fundamental of Gaseous state, Kinetic Theory of gases.

CO5. Gas laws, Vander waal's equation

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3					
PO-4				✓	
PO-5			✓		
PO-6		✓			
PO-7	✓	✓	✓	✓	✓
PO-8					
PO-9	✓			✓	
PO-10					
PO-11					



## Course Outcomes

### B.Sc. III Semester

#### DSC-3 CONDUCTANCE, ELECTRO CHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY II

After completion of course the students will be able to:-

- CO 1. Recall the fundamental concepts of thermodynamics such as system operations and functions.
- CO2. Explain the mechanism of different organic reactions such as nucleophilic addition, Substitution elimination rearrangement reactions.
- CO 3. Compare Valence bond theory and crystal field theory of coordination compounds.
- CO4. Apply the laws of Thermodynamics to explain enthalpy relation between heat capacities, entropy, change, isothermal mixing of ideal gases.
- CO5. Design new organic reactions in order to achieve the required products.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3				✓	
PO-4		✓		✓	
PO-5		✓			✓
PO-6					✓
PO-7	✓	✓	✓	✓	✓
PO-8					
PO-9					
PO-10					
PO-11					

## Course Outcomes

### B.Sc. III Semester

#### DSE- 1 s, p, d, AND f BLOCK ELEMENT

After completion of course the students will able to:-

- CO 1. To Understand the electronic elements configuration of s,p,d,& f block elements.
- CO2.To explain the general concepts on group relation and periodic properties of s,p,d, and block elements .
- CO3. Differentiate the similarities and dissimilarities of lanthanides and actinides.
- CO4.Analyse magnetic and spectral properties of transition metal complexes.
- CO5. Inculcate consequences of lanthanide and actinide contraction.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3				✓	
PO-4	✓	✓			
PO-5		✓			
PO-6					✓
PO-7	✓	✓	✓	✓	✓
PO-8	✓	✓		✓	
PO-9					
PO-10					
PO-11					



## Course Outcomes

### B.Sc. IV Semester

#### DSC-4 CHEMICAL KINETICS,SURFACE CHEMISTRY AND THERMODYNAMICS

After completion of course the students will able to:-

CO1. Recall different concepts of Acids & Bases like Arrhenius, Bronsted Lawry,Lux flood, Lewis acid base concept.

CO2. Compare the properties of lanthanides and actinides.

CO3. Compare and contrast between ionic equilibrium and phase equilibrium.

CO4. Elucidate the structure of benzene diazonium chloride.

CO5. Explain structural features affecting basicity of amines.

CO6. Apply the concept of fluorescence Phosphorescence and chemiluminescence for describing materials.

CO7. Analyse the characteristics of electromagnetic radiation and laws of photo chemistry.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7
PO- 1	✓	✓	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓	✓	✓
PO-3				✓			
PO-4	✓					✓	
PO-5				✓			
PO-6					✓		
PO-7	✓	✓	✓	✓	✓	✓	✓
PO-8							✓
PO-9							
PO-10							
PO-11	✓				✓		

## Course Outcomes

### B.Sc. IV Semester

#### DSE-2 MOLECULES OF LIFE

After completion of course the students will able to:-

- CO 1. Learn and demonstrate how the structure of biomolecules determines their chemical properties, reactivity and biological uses.
- CO2. Gain an insight into mechanism of enzyme action and inhibition.
- CO3. Understand the basic principles of drug-receptor interaction and SAR.
- CO4. Understand biological processes like replication, transcription and translation.
- CO5. Demonstrate an understanding of metabolic pathways, their inter-relationship, regulation and energy production from.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3				✓	
PO-4	✓	✓	✓	✓	✓
PO-5		✓			
PO-6					✓
PO-7	✓	✓	✓	✓	✓
PO-8	✓	✓	✓	✓	✓
PO-9					
PO-10					
PO-11					

## Course Outcomes

### B.Sc. V Semester

DSC-5 COORDINATION CHEMISTRY FUNCTIONAL GROUP ORGANIC CHEMISTRY IV

**After completion of course the students will able to:-**

- CO1. Recall valence bond theory and crystal field theory.
- CO2. Explain concept of color and chemical constitution and aromaticity in 5 & 6 membered heterocyclic chemistry.
- CO3. Explain the basics of quantum mechanics via various effects, operations and Equations.
- CO4. Compare and contrast between molecular orbital and valence bond models.
- CO5. Analyse Characteristics of electromagnetic radiation regions intensity and representation of spectra.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3		✓	✓		✓
PO-4					
PO-5					✓
PO-6					✓
PO-7	✓	✓	✓	✓	✓
PO-8		✓	✓	✓	✓
PO-9					
PO-10					
PO-11					

## Course Outcomes

### B.Sc. V Semester

#### DSE-3 ORGANOMETALLIC CHEMISTRY

After completion of course the students will able to:-

- CO1. Have a good overview of the fundamental principles of organotransition – metal chemistry and know how chemical properties are affected by metals and ligands.
- CO2. Be able to the use knowledge about structure and bonding issues to understand the stability and reactivity of simple organometallic complex.
- CO3. Have insight into the use of modern method to characterize sandwich compounds.
- CO4. Understand fundamental reaction types and mechanisms and how to combine there to understand efficient catalytic proceses.
- CO5. Know important application of organometallic homogenous. Catalysis in the production of large –scale (bulk) and smaller –scale (fine chemicals )production.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3				✓	
PO-4		✓			
PO-5		✓			
PO-6					✓
PO-7	✓	✓	✓	✓	✓
PO-8	✓	✓			✓
PO-9					✓
PO-10					
PO-11					

## Course Outcomes

### B.Sc. VI Semester

#### DSC-6 QUANTUM CHEMISTRY & PHOTOCHEMISTRY

After completion of course the students will able to:-

CO1. Understand bonding and preparation of metal carbonyl and inorganic polymers.

CO2. Explain the role of metal in biological system.

CO3. Describe the basic principles and application of IR,U.V. and NMR spectroscopy.

CO4. Evaluate vibrational, Raman,Electronic Spectroscopic techniques and there fundamental conceptional principles

CO5. Apply electro chemical, Galvanic and Concentration cell in determining valency of ions, solubility and activity coefficient.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3				✓	✓
PO-4	✓	✓	✓	✓	✓
PO-5					
PO-6		✓			
PO-7	✓	✓	✓	✓	✓
PO-8	✓			✓	✓
PO-9					
PO-10					
PO-11					

## Course Outcomes

### B.Sc. VI Semester

#### DSE-4- SOLID STATE AND MOLECULAR SPECTROSCOPY

After completion of course the students will able to:-

- CO1. Understand the form of solid , crystal system identification lattice plane.
- CO2. Explain Law of rational indices, structure of different crystals, and defects of crystals.
- CO3. Describe the basic principles of NMR, electronic spectroscopy, Electron spin Resonance Spectroscopy
- CO4. Evaluate vibrational Raman, Electron Spectroscopy techniques and their application.
- CO5. Apply,rotational vibrational, Electronic and NMR Spectroscopy on structure determination of compounds.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3					✓
PO-4	\	✓	✓	✓	✓
PO-5					
PO-6		✓			
PO-7	✓	✓	✓	✓	✓
PO-8	✓			✓	✓
PO-9					
PO-10					
P0-11					

## **Programme Outcomes for PG**

**PO 1 : Critical Thinking :** Inculcate critical thinking to carry out scientific investigation objectively. Formulate coherent arguments : Critically evaluate practices, policies and theories by following scientific approach to knowledge development .Critically evaluate ideas ,evidence from an open –minded and reasoned perspective.

**PO 2: Knowledges Skill :** Equip the student with skill to analyse problems, formulate an hypothesis, evaluate and validate results, and draw reasonable conclusions thereof .Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non- familiar problems ,rather than replicate curriculum content knowledge.

**PO 3: Scientific Communication Skill :**Imbibe effective scientific and /or technical communication in both oral and writing .Ability to show the importance of the subject as precursor to various scientific development since the beginning of the civilization.

**PO 4: Ethics :** Continue to acquire relevant knowledge and skill appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned .Ability to identify unethical behavior such as fabrication .falsification or misrepresentation of data and adoptive objective , unbiased and truthful action in all aspects.

**PO 5 : Enlightened Citizenship:** Create awareness in become an enlightened citizen with commitment to deliver one`s responsibilities within the scope of bestowed right and privileges.

**PO 6: Analytical Reasoning :** Ability to evaluate the reliability and relevance of evidence ,identify logical flaws and holes in the arguments of others ,analyse and synthesise data from a variety of sources : draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

**PO 7: Multicultural Competence :** Development of asset of competencies in other to enhance and promote the growth of multicultural sensitivity within universities , Integrating multicultural awareness such as race, gender ,physical ability, age income and other social variables , and by creating an environment that is , ”welcoming for all students”.

**PO 8 : Lifelong Learning :** Ability to think , acquire knowledge and skill though logical reasoning and to inculcate the habit of self – learning though out life, thorough self –paced and self – directed learning aimed at personal development and adapting to changing academic demands of work place through knowledge skill development / reskilling.

**PO 9: Leadership Qualities :** Capability for mapping out the tasks of a learn or an organization ,and setting direction, formulating an inspiring vision ,building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision ,and using management skill to guide people to the right destination in a smooth and efficient way.

**PO 10 : Research Skill :** Prepare student for pursuing research or in industry in concerned subject and allied fields, Capability to use appropriate software to solve various problems.

## Attributes of a Chemistry Graduate

Attributes of chemistry graduate under the outcome –based teaching – learning framework may encompass the following :

- **Core competency** : The chemistry graduates are expected to know the fundamental concepts of chemistry and applied chemistry. These fundamental concepts would reflect the latest understanding of the field, and therefore , are dynamic in nature and require frequent and time- bound revisions.
- **Communication Skills** : Chemistry graduates are expected to possess minimum standards of communication skill expected of a science graduate in the country. They are expected to read and understand documents with in-depth analyses and logical arguments. Graduates are expected to be well-versed in speaking and communicating their idea/ finding/concepts to wider audience.
- **Psychological Skills** : Graduates are expected to possess basic psychological skill required to face the world at large, as well as the skill to deal with individuals and students of various sociocultural , economic and educational level. Psychological skill may include feedback loops, self – compassion , Self reflection, goal –setting, interpersonal relationship and emotional management.
- **Problem -Solving** : Graduates are expected to be equipped with problem – solving philosophical approaches that are pertinent across the disciplines.
- **Analytical Reasoning** : Graduates are expected to acquire formulate cogent arguments and spot logical flaws, inconsistencies, circular reasoning etc.
- **Research –Skill** : Graduates are expected to be keenly observant about what is going on in the natural surroundings to awake their curiosity. Graduates are expected to design a scientific experiment though statistical hypothesis testing and other a priori reasoning including logical deduction.
- **Teamwork** : Graduates are expected to be team players, with productive co-operations involving members from diverse socio- cultural backgrounds.
- **Digital Literacy** : Graduates are expected to be digitally literate for them to enroll and increase their core competency via e-learning resources such as **MOOC** and other digital tools for lifelong. Graduates should be able to spot data fabrication and fake news by applying rational skepticism and analytical reasoning.
- **Moral and ethical awareness**: Graduates are expected to be responsible citizen of India and be aware of moral and ethical baseline of the country and the world. They are expected to define their core ethical virtues good enough to distinguish what construes as illegal and crime in Indian constitution. Emphasis be given on academic and research ethics, including fair Benefit Sharing ,Plagiarism, Scientific Misconduct and so on.
- **Leadership readiness**: Graduates are expected to be familiar with deciding making process and basic managerial skill to become a better leader .Skill include defining objective vision and mission, how to become charing inspiring leader and so on.



## M.Sc. CHEMISTRY

### First Semester (CBCS)

Paper	Course Code	Course Type	Course (Paper/Subject)	Credits	Contact Hours Per Week			EoSE Duration (Hrs.)		Marks	
					L	T	P	Thy	P	SEE	IA
I	MSC 101	PD2	INORGANIC CHEMISTRY -1	6	4	3	0	3	0	70	30
II	MSC 102	PD2	ORGANIC CHEMISTRY-1	6	4	3	0	3	0	70	30
III	MSC 103	PD2	ANALYTICAL CHEMISTRY	6	4	3	0	3	0	70	30
	MSC 111	PD2	INORGANIC CHEMISTRY - 1LAB	6	0	0	9	0		100	
	MSC 112		ANALYTICAL CHEMISTRY- 1LAB							100	
IV	MSC 104	PD2	SOCIAL OUTREACH, ENTERPRENEURSHIP & INTERNSHIP	6	4	3	0	3	0	100	
V	MSC 105	PD2	CONSTITUTIONALISM & INDIAN POLITICAL SYSTEM	6	4	3	0	3	0	70	30
	MSC 106	PD2	GROUP THEORY, SPECTROSCOPY AND DIGGRACTION METHODS								
	MSC 107	PD2	COMPUTER PROGRAMMING IN CHEMISTRY								
	MSC 108	PD2	<b>MEDICINAL CHEMISTRY</b>								
	MINIMUM CREDITS IN INDIVIDUAL SUBJECT IS 6 AND IN COMPLETE SEMESTER IN WOULD BE 30			Total Credit =36							

## M.Sc. CHEMISTRY

### Second Semester (CBCS)

Paper	Course Code	Course Type	Course (Paper/Subject)	Credits	Contact Hours Per Week			EoSE Duration (Hrs.)		Marks	
					L	T	P	Thy	P	SEE	IA
I	MSC 201	PD2	INORGANIC CHEMISTRY -2	6	4	3	0	3	0	70	30
II	MSC 202	PD2	ORGANIC CHEMISTRY-2	6	4	3	0	3	0	70	30
III	MSC 203	PD2	PHYSICAL CHEMISTRY	6	4	3	0	3	0	70	30
	MSC 211	PD2	CHEMISTRY LAB ORGANIC	6	0	0	9	0		100	
	MSC 212		PHYSICAL CHEMISTRY LAB							100	
IV	MSC 204	PD2	RESEARCH METHODOLOGY & COMPUTER APPLICATION:BASICS	6	4	3	0	3	0	100	
V	MSC 205	PD2	ENVIRONMENTAL AND FOREST LAWS	6	4	3	0	3	0	70	30
	MSC 206	PD2	POLYMER CHEMISTRY								
	MSC 207	PD2	ORGANIC SYNTHESIS -1								
	<b>MSC 208</b>	PD2	<b>APPLIED CHEMISTRY</b>								
	MINIMUM CREDITS IN INDIVIDUAL SUBJECT IS 6 AND IN COMPLETE SEMESTER IN WOULD BE 30			Total Credit =36							

**M.Sc. CHEMISTRY**  
**Third Semester (CBCS)**

Paper	Course Code	Course Type	Course (Paper/Subject)	Credits	Contact Hours Per Week			EoSE Duration (Hrs.)		Marks	
					L	T	P	Thy	P	SEE	IA
I	MSC 301	PD2	APPLICATIONS OF SPECTROSCOPY- INORGANIC CHEMISTRY	6	4	3	0	3	0	70	30
II	MSC 302	PD2	APPLICATIONS OF SPECTROSCOPY- ORGANIC CHEMISTRY	6	4	3	0	3	0	70	30
III	MSC 303	PD2	PHOTOCHEMISTRY	6	4	3	0	3	0	70	30
	MSC 311	PD2	GENERAL CHEMISTRY LAB	6	0	0	9	0		200	
IV	MSC 304	PD2	INTELLECTUAL PROPERTYRIGHT	6	4	3	0	3	0	70	30
V	MSC 305	PD2	TRIBAL STUDIES	6	4	3	0	3	0	70	30
	MSC 306	PD2	GREEN CHEMISTRY								
	MSC 307	PD2	ORGANIC SYNTHESIS II								
	<b>MSC 308</b>	PD2	<b>HETROCYCLIC CHEMISTRY</b>								
	MINIMUM CREDITS IN INDIVIDUAL SUBJECT IS 6 AND IN COMPLETE SEMESTER IN WOULD BE 30			Total Credit =36							

## M.Sc. CHEMISTRY

### Fourth Semester (CBCS)

Paper	Course Code	Course Type	Course (Paper/Subject)	Credits	Contact Hours Per Week			EoSE Duration (Hrs.)		Marks	
					L	T	P	Thy	P	SEE	IA
I	MSC 401	PD2	BIOINORGANIC CHEMISTRY	6	4	3	0	3	0	70	30
II	MSC 402	PD2	ENVIRONMENTAL CHEMISTRY	6	4	3	0	3	0	70	30
III	MSC 403	PD2	SOLID STATE CHEMISTRY	6	4	3	0	3	0	70	30
	MSC 411	PD2	ORGANIC CHEMISTRY LAB.	6	0	0	9	0		200	
IV	MSC 404	PD2	DISSERTATION	6	4	3	0	3	0	100	
V	MSC 505	PD2	PHOTOINORGANIC CHEMISTRY	6	4	3	0	3	0	70	30
	MSC 406	PD2	MATERIAL SCIENCE								
	<b>MSC 407</b>	PD2	<b>CHEMISTRY OF NATURAL PRODUCT</b>								
	MINIMUM CREDITS IN INDIVIDUAL SUBJECT IS 6 AND IN COMPLETE SEMESTER IN WOULD BE 30			Total Credit =36							

## Programme Outcomes for PG

**PO 1 : Critical Thinking :** Inculcate critical thinking to carry out scientific investigation objectively Formulate coherent arguments : Critically evaluate practices, policies and theories by following scientific approach to knowledge development .Critically evaluate ideas ,evidence from an open –minded and reasoned perspective.

**PO 2: Knowledges Skill :** Equip the student with skill to analyse problems, formulate an hypothesis, evaluate and validate results, and draw reasonable conclusions thereof .Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non- familiar problems ,rather than replicate curriculum content knowledge.

**PO 3: Scientific Communication Skill :**Imbibe effective scientific and /or technical communication in both oral and writing .Ability to show the importance of the subject as precursor to various scientific development since the beginning of the civilization.

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**PO 10 : Research Skill :** Prepare student for pursuing research or in industry in concerned subject and allied fields, Capability to use appropriate software to solve various problems.

**COURSE OUTCOME**

**M.Sc. I SEMESTER**

**COURSE CODE : D2**

**PAPER CODE :101**

**PAPER : I (INORGANIC CHEMISTRY -1)**

**After completion of course, the students will able to:-**

- CO 1. Recall the principles of electronic structure bonding & reactivity of coordination complexes.
- CO 2. Understand the concepts of reactions .Through the mechanism in transition Metal complexes.
- CO 3. Develop the understanding of structure and bonding of metal carbonyls.
- CO4. Apply the different theories of coordination chemistry to elucidate the structureof different complexes.
- CO5. Interpret the structure of crytpands inclusion compounds,isopoly & heteropoly acids.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓				
PO-2		✓		✓	
PO-3	✓				
PO-4					
PO-5					
PO-6	✓		✓		
PO-7					
PO-8			✓		
PO-9					
PO-10	✓	✓	✓	✓	✓

## COURSE OUTCOME

M.Sc. I SEMESTER

COURSE CODE : PD2

PAPER CODE : 102

PAPER : II ( ORGANIC CHEMISTRY -1 )

After completion of course the students will able to:-

- CO1. Recall the fundamental principles of stereochemistry applied to different organic reactions.
- CO2. Understand the concepts related to synthesis, mechanism of functions of various organic reactions.
- CO 3. Analyse the product distribution of stereochemistry of various products through spectroscopic data.
- CO 4. Evaluate the organic reactions based on the influence of the substituents on substrate molecules and nature of solvent & the parametric conditions.
- CO 5. Design new organic reactions in order to achieve the required products.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓				
PO-2		✓			
PO-3					
PO-4					
PO-5					
PO-6			✓		✓
PO-7					
PO-8	✓				
PO-9					
PO-10	✓	✓	✓	✓	✓

**COURSE OUTCOME**  
**M.Sc. I SEMESTER**  
**COURSE CODE : PD2**  
**PAPER CODE : 103**  
**PAPER : III (ANALYTICAL CHEMISTRY)**

After completion of course the students will able to:-

CO 1. Understand fundamentals of chemical analysis.

CO 2. Analyse different errors using statistical methods in chemical analysis.

CO3. Evaluate errors in chemical analysis through statistical treatment of data through F- Test. T-Test & Q- Test.

CO4. Analyse thermal behaviour of different organic and inorganic materials using TGA,DTA& DAC.

CO5. Adopt different chromatographic techniques for isolation of important organic compounds.

CO 6. Apply absorption and emission techniques for traced elements analysis from different matrices.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1	✓		✓		✓	
PO-2						
PO-3		✓				
PO-4						
PO-5						
PO-6	✓	✓	✓	✓	✓	✓
PO-7						
PO-8						
PO-9						
PO-10			✓	✓	✓	✓



**COURSE OUTCOME****M.Sc. I SEMESTER****COURSE CODE : PD2****PAPER CODE : 111****PAPER : (INORGANIC CHEMISTRY-1 LAB.)****After completion of course the students will able to :-**

CO 1. Prepare the solutions for quantitative analysis .

CO 2. Apply the knowledge of quantitative analysis for the determination of metal ions.

CO 3. Understand the principle for qualitative analysis of acid.  
basic radicals in inorganic mixture.

	CO-1	CO-2	CO-3
PO- 1			
PO-2	✓		
PO-3		✓	
PO-4			
PO-5			
PO-6	✓	✓	
PO-7			
PO-8	✓		
PO-9			
PO-10	✓	✓	✓

## **COURSE OUTCOME**

**M.Sc. I SEMESTER**

**COURSE CODE : PD-2**

**PAPER CODE : 112**

**PAPER: (ANALYTICAL CHEMISTRY -1 LAB.)**

**After completion of course the students will able to:-**

- CO 1. Understand various methods for volumetric and gravimetric analysis of various Chemical constituents.
- CO2. Evaluate different contaminants I material using Nephelometry, Colorimetry,Flamephotometry.
- CO 3. Analyse the errors obtained by estimations.
- CO 4. Design chromatographic and titrimetric methods for identification of species

	CO-1	CO-2	CO-3	CO-4
PO- 1				
PO-2	✓			
PO-3		✓	✓	✓
PO-4				
PO-5				
PO-6			✓	
PO-7				
PO-8				
PO-9				
PO-10	✓	✓		✓

**COURSE OUTCOME  
M.Sc. I SEMESTER**

**COURSE CODE : PD2**

**PAPER CODE : 104**

**PAPER : SOCIAL OUTREACH,ENTERPRENEURSHIP**

**& INTERNSHIP**

**After completion of course the students will able to:-**

The course will help students to enhanced the academic skill and  
responsibilitiestowards society.

## **COURSE OUTCOME**

**M.Sc. I SEMESTER**

**COURSE CODE : PD2**

**PAPER CODE : 105**

**PAPER : V- CONSTITUTIONALISM &INDIAN POLITICAL  
SYSTEM**

**After completion of course the students will able to:-**

CO 1. Understand the making of Indian constitution along with the debates of constituent assembly.

CO 2. Acquire the knowledge of various constitution statutory bodies.

CO 3. Describe the working of election commission and election rocess.

CO 4. Analyse the division of power between various organs of the governmentat different level .

	CO-1	CO-2	CO-3	CO-4
PO- 1	✓			
PO-2		✓		
PO-3		✓		
PO-4	✓			
PO-5	✓			
PO-6				✓
PO-7				
PO-8			✓	
PO-9		✓		✓
PO-10				

## **COURSE OUTCOME**

**M.Sc. I SEMESTER**

**COURSE CODE : PD2**

**PAPER CODE : 106**

**PAPER : V GROUP THEORY,SPECTROSCOPY  
AND DIFFRACTION METHODS**

**After completion of course the students will able to:-**

CO 1. Understand diffraction techniques to elucidate the structure of solids.

CO 2. Acquire depth knowledge in group theory and molecular spectroscopy .

CO 3. Understand concepts of NMR & ESR spectroscopy & apply the concept for structural elucidation.

CO 4. Apply the concepts of photoelectron spectroscopy to simple molecules.

	CO-1	CO-2	CO-3	CO-4
PO- 1		✓		
PO-2				✓
PO-3	✓			
PO-4				
PO-5				
PO-6		✓	✓	
PO-7				
PO-8	✓			
PO-9				
PO-10	✓	✓	✓	✓

**COURSE OUTCOME**  
**M.Sc. I SEMESTER**  
**COURSE CODE : PD2**  
**PAPER CODE : 107**

**PAPER : V COMPUTER PROGRAMMING IN CHEMISTRY**

**After completion of course the students will able to :-**

- CO 1. Understand fundamentals of programming .
- CO 2. Critically assess the applicability of computational methods to specific problems in chemistry.
- CO 3. Successfully apply appropriate computational techniques in their academic & scientific careers.
- CO 4. Hands on training in context of currently available computational chemistry software & high Performance computer hardware.
- CO 5. Develop computational thinking (ability to translate vast data in to abstract concepts and to understand data based reasoning).

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1					
PO-2					
PO-3	✓		✓	✓	
PO-4					
PO-5		✓			
PO-6				✓	
PO-7		✓			✓
PO-8					
PO-9					
PO-10	✓	✓	✓	✓	✓

**COURSE OUTCOME**

**M.Sc. I SEMESTER**

**COURSE CODE : PD2**

**PAPER CODE : 108**

**PAPER : V (MEDICINAL CHEMISTRY )**

**After completion of course the students will able to:-**

- CO 1. Recall the basics of drug receptor interactions & types of receptors.
- CO 2. Understand the mechanism of action of drugs based on physic chemical factors& mode of synthesis of selected drugs.
- CO 3. Analyse mechanism pathways of different class of medicinal compounds to learn indepth about the clinical application & current trends of antibiotics and macrolides.
- CO 4. Apply their knowledge in proper usage of drugs based on their mechanism ofaction& SAR.
- CO 5. Evaluate correlation between pharmacology of a disease & its mitigation of cure.
- CO 6. Design & synthesis new drugs based on the knowledge acquired on the existing drugs .

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1					✓	
PO-2	✓					
PO-3						✓
PO-4						
PO-5				✓		
PO-6			✓			
PO-7						
PO-8		✓				
PO-9						
PO-10	✓	✓	✓	✓	✓	✓

## SECOND SEMESTER

### COURSE OUTCOME

#### M.Sc. II SEMESTER

COURSE CODE : PD2

PAPER CODE : 201

PAPER : I (INORGANIC CHEMISTRY -2)

After completion of course, the students will have :-

- CO1. A comprehensive knowledge of electronic spectra and magnetic properties of transition metal complexes.
- CO2. A critical understanding of spectroscopic ground states, Orgel and Tanabe-Sugano diagrams, optical activity, magnetic exchange coupling, spin crossover, electron transfer and how spectral bands obtained from metal complexes..
- CO3. An ability to compare and contrast metal clusters such as higher boranes, carboranes, metalloboranes, as well as homogeneous and heterogeneous catalysis by organometallic compounds.
- CO4. A critical inclination of bioorganic chemistry in biological systems as transport proteins, oxygen carriers, metalloenzymes, iron-sulphur protein and role of metals ions in functioning of biological processes.
- CO5. Analysis of complexes and its stability thermodynamic aspects of complex formation and factors. HSAB provide information about nature of metal ligand complex formation and various stereochemical aspects.
- CO6. To apply inorganic complexes which have major application in industrial processes, chemical synthesis and anticancerous drugs.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO-1				✓		
PO-2				✓		
PO-3	✓				✓	
PO-4						
PO-5						
PO-6			✓		✓	✓
PO-7						
PO-8		✓				
PO-9						
PO-10	✓	✓	✓	✓	✓	✓



## COURSE OUTCOME

### M.Sc. II SEMESTER

COURSE CODE : PD2

PAPER CODE : 202

PAPER : II (ORGANIC CHEMISTRY -2)

After completion of course, the students will able to :-

- CO1. Understand the concept of various addition to C-C, hetero-multiple bonds, electrophilic and nucleophilic reactions which are important part of organic synthesis.
- CO2. Explain the mechanisms of different redox reactions which play key role in conversion of various organic compounds.
- CO3. Compare and contrast oxidation, reduction, rearrangement reactions and rank the organic compounds in order to their oxidation level and structural isomer to form new compound.
- CO4. Analyze molecular rearrangements and another aspects to form different scaffolds through mechanism, generate divers heterocyclic compounds through chemical transformation.
- CO5. Evaluate the various aspects of content studying the growth and development of organic compounds and to appraise identification analysis with their structural mechanism.
- CO6. Develop possible thermodynamic and kinetic approach in determination of energystates, intermediate, steric and isotope effects.
- CO7. Create mechanisms to synthesize all kinds of natural products, heterocyclic compounds, vitamins steroids and drugs.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7
PO- 1		✓					
PO-2	✓				✓		
PO-3							✓
PO-4							
PO-5							
PO-6			✓	✓			
PO-7		✓					
PO-8	✓					✓	
PO-9							
PO-10					✓	✓	✓

**COURSE OUTCOME**  
**M.Sc. II SEMESTER**  
**COURSE CODE : PD2**  
**PAPER CODE : 203**

**PAPER : III (PHYSICAL CHEMISTRY )**

**After completion of course, the students will able to :-**

- CO1. Critical understanding the concept of recapitulation, width, intensity of spectral lines, rotational and Raman spectra of di- and poly-atomic molecules.
- CO2. Discuss the fourier transform signal processing , image processing , heat distribution , mapping wave simplification differaction and radiation measurement.
- CO3. Explain Raman and electronic spectroscopy which gives information about rotation, vibration polarization, coarse, fine and electronic structure of molecules.
- CO4. Compare and contrast neutron and electron diffraction which elaborate scattering of neutrons,magnetic scattering, scattering angles structure determination of solid and liquid and gas phase molecules .
- CO5 .Analyse the quantum chemistry which continues to show its value in supporting and interpretation experimental spectroscopic data predict arrangement of electron, rates of chemical reaction and physical properties of molecules.
- CO6. Evaluate selected technological application of surface chemistry that plays an indispensable role in adsorption, capillary action estimation of surface area, micellization and catalytic activity.
- CO7. Apply these spectroscopic techniques in structure determination, elucidation and identification of compounds which is useful in science, engineering and throughout modern industrialization.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7
PO- 1	✓	✓					
PO-2	✓		✓		✓		
PO-3							
PO-4							
PO-5							
PO-6	✓	✓	✓				
PO-7						✓	
PO-8			✓				
PO-9							✓
PO-10	✓	✓		✓	✓		✓

**COURSE OUTCOME**  
**M.Sc. II SEMESTER**  
**COURSE CODE : PD2**  
**PAPER CODE : 211**

**PAPER : (ORGANIC CHEMISTRY LAB)**

**After completion of course, the students will able to :-**

- CO1. Learn qualitative analysis, purification and identification using TLC, chromatography, chemical test and IR spectra.
- CO2. Synthesize organic compounds via different steps and procedures such as acetylation, oxidation, Aldol condensation and Sandmeyer reaction.
- CO3. Analyze quantitatively by estimation and measurement through classical and advanced techniques.

	CO-1	CO-2	CO-3
PO- 1	✓	✓	
PO-2	✓		✓
PO-3			
PO-4			
PO-5			
PO-6	✓	✓	✓
PO-7			
PO-8		✓	
PO-9			
PO-10	✓	✓	

## COURSE OUTCOME

M.Sc. II SEMESTER

COURSE CODE : PD2

PAPER CODE : 212

PAPER: (PHYSICAL CHEMISTRY LAB)

**After completion of course, the students will able to :-**

- C01. Give the concept of adsorption by studying surface chemistry and phase equilibrium of different component system.
- C02. Determine the effect of temperature, concentration, ionic strength, catalyst and rate of reaction.
- C03. Perform conductometry to determine velocity constant, order of reaction, activity coefficient, weak and strong electrolytes.
- C04. Apply potentiometric and pH metric titrations to determine strength, valency, dissociation and thermodynamic constant.

	CO-1	CO-2	CO-3	CO-4
PO- 1			✓	✓
PO-2	✓			
PO-3		✓		
PO-4				
PO-5				
PO-6	✓	✓	✓	
PO-7				
PO-8	✓		✓	
PO-9				
PO-10				✓

## **COURSE OUTCOME**

**M.Sc. II SEMESTER**

**COURSE CODE : PD2**

**PAPER CODE : 204**

**PAPER : IV ( RESEARCH METHODOLOGY & COMPUTER  
APPLICATION : BASICS)**

**After completion of course, the students will able to :-**

- CO1. Acquire critical understanding the conceptual engagement with research, enables people to see a problem in new area of research, tools of research and sampling techniques.
- CO2. Have a Comprehensive knowledge of procedures such as historical, survey, case, comparative experimental etc. that followed in research methodology.
- CO3. Give a brief account of the writing research report helpful in documentation of the report with format and style.
- CO4. Analyse the data that will help in measurement, editing, coding, classification, tabulation and interpretation of results.
- CO5. Apply principles and applications of computer fundamentals such as MS word,MS excel and MS powerpoint etc. in various branches of sciences.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓				
PO-2	✓				
PO-3		✓		✓	✓
PO-4					
PO-5					
PO-6		✓	✓		
PO-7				✓	
PO-8	✓				
PO-9					
PO-10	✓	✓	✓	✓	✓

## COURSE OUTCOME

**M.Sc. II SEMESTER**

**COURSE CODE : PD2**

**PAPER CODE : 205**

**PAPER : V (ENVIRONMENTAL AND FOREST LAWS)**

**After completion of course, the students will able to :-**

- C01. Understand evolution of forest and wild life laws, importance of forest policy during British Regime, after independence and methods of conservation.
- C02. Explain forest protection act, laws and policies that give information about various acts and rules updated in different years.
- C03. Give the concept of multidisciplinary nature of environment, ecosystem, ecology and factors of degradation.
- C04. Introduce the acts, rules, policies, constitutional provision on environment protection, writ petitions and judicial activism.
- C05. Analyze legislative framework for pollution control laws to control air, water and noise pollution and waste management.
- C06. Review environmental constitutionalism about fundamental rights to equality, information, life through different articles and acts.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1	✓		✓		✓	
PO-2						✓
PO-3	✓	✓	✓	✓	✓	✓
PO-4	✓	✓	✓	✓	✓	✓
PO-5					✓	
PO-6						
PO-7			✓			
PO-8						
PO-9		✓		✓		
PO-10						

## COURSE OUTCOME

**M.Sc. II SEMESTER**

**COURSE CODE : PD2**

**PAPER CODE : 206**

**PAPER : V (POLYMER CHEMISTRY)**

**After completion of course, the students will able to :-**

- CO1. Understand basics of polymer chemistry and different techniques of polymerization.
- CO2. Describe kinetics and mechanisms of free radicals, cationic, anionic, co- ordination and degree of polymerization.
- CO3. Give the concept of structure and properties such as mechanical, thermal, crystallinity and various spectroscopic techniques and methods for molecularweight determination.
- CO4. Analyze industrial, natural or biopolymers and various electroluminescent, fire retardant, nanocomposite polymers that give information about degradable and non degradable nature of polymers
- CO5. To impart knowledge in the theory and application of various instrumental techniques which are very important characterization techniques for different industrial polymers.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1		✓			✓
PO-2	✓			✓	
PO-3		✓			
PO-4					
PO-5					
PO-6				✓	
PO-7					
PO-8	✓		✓		✓
PO-9					
PO-10				✓	✓

## COURSE OUTCOME

**M.Sc. II SEMESTER**

**COURSE CODE : PD2**

**PAPER CODE : 207**

**PAPER : V (ORGANIC SYNTHESIS-I)**

**After completion of course, the students will able to :-**

- CO1. Learn modern synthetic methods, reactions and reagents for the synthesis of organic molecules using standard reactions like acetylation, alkylation, Grignard and deprotonation of functional groups.
- CO2. Give information about C-C bond formation through various reaction like Henry, Wittig, Wordwoth Emmons and chemistry of enolates.
- CO3. Explain electrophilic reactions such as Prins, Vilsmeier-Hack reaction, Suzuki coupling and other miscellaneous reactions that gives information about its mechanism.
- CO4. Apply reagents such as K-selecteride, super hydrides, Fetizon, ceric ammonium nitrate, Gilman, lithium which are very important in synthesis of various organic compounds.
- CO5. Create mechanisms to synthesize all kinds of organic compounds, natural products, heterocyclic compounds, vitamins, steroids and drugs.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓			✓	✓
PO-2		✓	✓		
PO-3	✓				
PO-4					
PO-5					
PO-6			✓		
PO-7					
PO-8	✓			✓	
PO-9					
PO-10	✓	✓	✓	✓	✓



## COURSE OUTCOME

### M.Sc. II SEMESTER

**COURSE CODE : PD2**

**PAPER CODE : 208**

**PAPER : V (APPLIED CHEMISTRY)**

**After completion of course, the students will able to :-**

- CO1. Recall the chemistry of water quality parameters TDS, hardness, Dissolved oxygen and treatment of water through different techniques.
- CO2. Explain the pharmacokinetics and pharmacodynamics of drugs such as administration, absorption, elimination, different kinds of antibiotics and misuse of drugs.
- CO3. Compare and contrast between different kinds of polymers such as addition, condensation, thermoplastic, thermosetting and industrial application of polymers.
- CO4. Analyze chemistry of environmental pollutants that give the information about hazardous effect of pollutants on human health, control methods, removal and management techniques.
- CO5. Apply the concept of material chemistry in manufacturing of cement, setting of cement, paint, varnishes, adhesives, soaps and detergents .

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓		✓		✓
PO-2	✓	✓		✓	
PO-3					
PO-4					
PO-5		✓			
PO-6			✓	✓	
PO-7					
PO-8	✓				
PO-9					
PO-10			✓	✓	✓

### THIRD SEMESTER

**COURSE OUTCOME**  
**M.Sc. III SEMESTER**  
**COURSE CODE : PD2**  
**PAPER CODE : 301**

**PAPER : I (APPLICATION OF SPECTROSCOPY –  
INORGANIC CHEMISTRY )**

**After completion of course, the students will able to**

- C01. Acquire comprehensive knowledge of atomic absorption emission, flame emission and Raman Spectroscopy in inorganic chemistry.
- C02. Develop a critical understanding of Vibrational Spectroscopy and determination of various shapes of molecules and their mode of bonding.
- C03. Describe inclination of spectroscopy such as electron spin resonance and identification of transition metal complexes including biological system and inorganic free radicals.
- C04. Compare and contrast atomic spectroscopy and molecular Spectroscopy in identifying energies of atomic orbital, molecular orbital and various vibrational transitions and progression .
- C05. Apply Mossbauer spectroscopy in studies of iron complexes including different metal ions In determination of oxidation state, structure, metal ligand bonding and in equivalent Mossbauer atom.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1					
PO-2	✓	✓			
PO-3			✓		✓
PO-4					
PO-5					
PO-6	✓			✓	✓
PO-7					
PO-8			✓	✓	
PO-9					
PO-10	✓	✓			✓

## COURSE OUTCOME

M.Sc. III SEMESTER

COURSE CODE : PD2

PAPER CODE : 302

PAPER : II (APPLICATION OF SPECTROSCOPY-ORGANIC CHEMISTRY )

After completion of course, the students will be able to :-

- C01. Skilled in interpreting one ,two dimensional NMR spectroscopy, EPR & Mass spectroscopy to derive the information regarding the structure & stereochemistry of the molecules.
- C02. Understand the instrumental set up involved in different organic spectroscopic techniques.
- C03. Acquire knowledge of IR spectroscopy & related vibrational frequency data of different organic functional groups.
- C04. Apply the concepts to characterize different organic molecules by using given spectroscopic data .
- C05. Analyse the organic compound and structure determination using different spectroscopic tools and techniques.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓			✓	
PO-2		✓	✓		
PO-3	✓				
PO-4					
PO-5					
PO-6	✓		✓		✓
PO-7					
PO-8		✓			
PO-9					
PO-10	✓		✓	✓	✓

## COURSE OUTCOME

**M.Sc. III SEMESTER**  
**COURSE CODE : PD2**  
**PAPER CODE : 303**

**PAPER : III (PHOTOCHEMISTRY)**

**After completion of course the students will able to :-**

- CO1. Recall the fundamental principles of photochemical reaction.
- CO2. Understanding the concepts related to light induced organicsynthesis , mechanism &the functions of various reagents .
- CO3. Apply their understanding about the photochemical reaction of industrialsignificance.
- CO4. Analyze the product distribution and the stereochemistry of variousorganic products derived from photochemistry.
- CO5. Evaluate the photochemistry reactions based on the influence of thesubstituents on substrate molecules.
- CO6. Design new photochemical reactions in order to achieve the required products.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1	✓		✓			
PO-2		✓			✓	✓
PO-3			✓			
PO-4						
PO-5						
PO-6				✓		
PO-7			✓			
PO-8	✓					✓
PO-9						
PO-10	✓	✓		✓	✓	✓

## COURSE OUTCOME

**M.Sc. III SEMESTER**

**COURSE CODE : PD2**

**PAPER CODE : 311**

**PAPER : (GENERAL CHEMISTRY LAB)**

**After completion of course the students will able to :-**

- CO1. Understand principles and techniques for identification of metal ion using pH meter, spectrophotometer, flame photometer and nephelometer.
- CO2. Analyse the metal ion mixture by paper chromatography and thin layer chromatography.
- CO3. Apply concept of physical analysis and organic chemistry through experiments. .
- CO4 .Design experiments in physical chemistry, analytical chemistry using conductometry, colorimeter, pH meter potentiometer .

	CO-1	CO-2	CO-3	CO-4
PO- 1	✓	✓		
PO-2	✓		✓	✓
PO-3				
PO-4				
PO-5				
PO-6		✓		
PO-7	✓			
PO-8				✓
PO-9				
PO-10	✓	✓	✓	✓

**COURSE OUTCOME**  
**M.Sc. III SEMESTER**  
**COURSE CODE : PD2**  
**PAPER CODE : 304**

**PAPER : IV(INTELLECTUAL PROPERTY,HUMAN RIGHT & ENVIRONMENT : BASICS)**

**After completion of course the students will able to :-**

- CO 1. Understand implication of patent, copyright ,trademark to an inventor & business organizations .
- CO2. Identify different types of intellectual properties (IPs),the right of ownership, scope of protection as well as the ways to create and to create and to extract value from IP.
- CO3. Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product &technology development.
- CO4. Identify activities & constitute IP infringements &the remedies available to the IP owner and describe the precautions steps to be taken to prevent infringement of proprietary development.
- CO5. Be familiar with the processes of intellectual property management (IPM) and various approaches for IPM and conducting IP & IPM auditing & explain how IPcan be managed as a strategic resource of suggest IPM strategy .
- CO 6. Be able to anticipate & subject to critical analysis arguments relating to the development &reform of intellectual property right institutions and their likely impact on creativity & innovation.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1		✓	✓			
PO-2						
PO-3	✓	✓			✓	
PO-4	✓	✓	✓			
PO-5				✓	✓	✓
PO-6						
PO-7						
PO-8						
PO-9	✓	✓	✓	✓		
PO-10						

**COURSE OUTCOME  
M.Sc. III SEMESTER**

**COURSE CODE : PD2**

**PAPER CODE : 305**

**PAPER : V (TRIBAL STUDIES )**

**After completion of course the students will able to :-**

- C01. Know about the tribal development in India fram pre-independene to present day.CO 2. Understand the tribal culture ,life and their situation in India.  
C03. Classify the tribals based on,Racial Lingnal Geographical & Cultural .  
C04. Develop Zeal to work for tribal people and their development in different department, Government and non govermental organizations.  
C05. Analyse the problem of tribals like prostitution, culture decay due to assimilation replacement & rehabilitation etc.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1			✓	✓	✓
PO-2					
PO-3	✓	✓			
PO-4					
PO-5					
PO-6		✓			
PO-7					
PO-8					✓
PO-9	✓	✓		✓	✓
PO-10				✓	

**COURSE OUTCOME**  
**M.Sc. III SEMESTER**  
**COURSE CODE : PD2**  
**PAPER CODE : 306**

**PAPER : V (GREEN CHEMISTRY)**

**After completion of course the students will able to :-**

- C01. To provide various methodologies used in organic synthesis, which enable the student to think different possible ways to synthesis an organic compound in anecofriendly way.
- C02. To get an idea of greener methodologies using ultrasound and microwavemethodologies.
- C03. To Know the solvent less & aquatic phase reactions.
- C04. Students will be able to understand the application of bio catalysts in organic synthesis.
- C05. To understand the design of chemical or eliminate the use and generation of hazardous substance.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓		✓		
PO-2		✓		✓	
PO-3					
PO-4		✓			✓
PO-5					
PO-6					
PO-7	✓	✓			
PO-8	✓			✓	
PO-9					
PO-10			✓	✓	✓



**COURSE OUTCOME**  
**M.Sc. III SEMESTER**  
**COURSE CODE : PD2**  
**PAPER CODE : 307**

**PAPER : V (ORGANIC SYNTHESIS -II )**

**After completion of course the students will able to:-**

- CO1. Recollect the fundamental principles of organic reactions.  
CO2. Understand the concept related to synthesis, mechanisms & the function of various reagents.  
CO3. Apply Their understanding about the retrosynthetic approaches involved in organic reaction of industrial significance.  
CO4. Analyze the product distribution & the stereochemistry of various organic products through spectroscopic data.  
CO5. Evaluate the organic reactions & methodologies based on the influence of the substituents on substrate molecules & nature of solvent & the parametric conditions.  
CO6. Design new organic reactions in order to achieve the required retrosynthesis products.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO-1	✓					✓
PO-2			✓	✓	✓	
PO-3		✓				
PO-4						
PO-5						
PO-6				✓		
PO-7						
PO-8	✓					
PO-9						
PO-10		✓	✓	✓	✓	✓

**COURSE OUTCOME**  
**M.Sc. III SEMESTER**

**COURSE CODE : PD2**

**PAPER CODE : 308**

**PAPER : V (HETEROCYCLIC CHEMISTRY )**

After completion of course the students will able to:-

- C01. Recall the significance of fundamental aspect of heterocyclic compounds.  
C02. Understand the concepts related to the nomenclature, structural aspects, synthesis reactions mechanism of three, four, five, six and seven membered heterocyclic.  
C03. Apply their understanding about heterocyclic reaction of industrial and medicinal uses .  
C04. Analyse the stereochemistry of products of various heterocyclic reaction.  
C05. Evaluate the heterocyclic reaction based on influence of the substituents on substrate molecule and nature of solvent and the parametric condition.  
C06. Create new heterocyclic reaction in on order to achieve the required products.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1	✓	✓	✓			
PO-2				✓		✓
PO-3	✓					
PO-4						
PO-5	✓					
PO-6		✓			✓	
PO-7		✓	✓	✓		
PO-8						✓
PO-9						
PO-10			✓	✓	✓	✓

**FOURTH SEMESTER  
COURSE OUTCOME  
M.Sc. IV SEMESTER  
COURSE CODE : PD2  
PAPER CODE : 401**

**PAPER : I (BIOINORGANIC CHEMISTRY)**

**After completion of course the students will able to :-**

- CO1. Understand the importance of metal ions in living organism.
- CO2. Gain knowledge of different type of enzymes in animals and plants.
- CO3. Explain Identify the medicinal applications of inorganic compound of various disease.
- CO4. select and integrate the Chemistry of metalloenzyme and the mechanical aspects of Organometallic compound.

	CO-1	CO-2	CO-3	CO-4
PO- 1	✓			✓
PO-2				
PO-3		✓		✓
PO-4		✓		
PO-5				
PO-6				
PO-7			✓	
PO-8	✓			✓
PO-9				
PO-10			✓	✓

**COURSE OUTCOME**  
**M.Sc. IV SEMESTER**  
**COURSE CODE :PD2**  
**PAPER CODE : 402**

**PAPER : II(ENVIRONMENTAL CHEMISTRY )**

**After completion of course the students will able to :-**

- CO1. Explain the course, consequence and cure of various type of pollution.
- CO2. Describe the methods to analyse and control our and water pollution.
- CO3. Classify and understand various analytical techniques for analysis of pollutants.
- CO4. Asses the implication of climate change.
- CO5. Acquire knowledge of pesticides and their effects on agriculture.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓			✓	
PO-2		✓	✓		
PO-3					
PO-4				✓	
PO-5	✓	✓	✓		✓
PO-6				✓	
PO-7					
PO-8	✓				
PO-9	✓			✓	
PO-10					

**COURSE OUTCOME**

**M.Sc. IV SEMESTER**

**COURSE CODE : PD2**

**PAPER CODE : 403**

**PAPER : III (SOLID STATE CHEMISTRY)**

**After completion of course the students will able to :-**

CO1. Recall basic concepts of bonding in solids

CO2. Analyse bonding in solid state chemistry electronegativity, radii and packing of atoms Band theory.

CO3. Analyse information from various structure characterisation methods and utilize powder X-ray diffraction data from phase identification.

CO4. Explain basic structures-crystal defects.

	CO-1	CO-2	CO-3	CO-4
PO-1	✓		✓	
PO-2		✓		✓
PO-3				
PO-4				
PO-5				
PO-6		✓	✓	
PO-7				
PO-8	✓			✓
PO-9				
PO-10		✓	✓	✓

**COURSE OUTCOME**  
**M.Sc. IV SEMESTER**

**COURSE CODE : PD2**

**PAPER CODE : 411**

**PAPER : (ORGANIC CHEMISTRY LAB. )**

**After completion of course the students will able to :-**

CO1. Isolation and identification of nature products .

CO2. Different type of reactions involved in synthesis of organic compounds.

CO3. Spectroscopic identification and estimations of organic compounds.

	CO-1	CO-2	CO-3
PO- 1		✓	
PO-2	✓		✓
PO-3			
PO-4			
PO-5			
PO-6		✓	
PO-7		✓	
PO-8			✓
PO-9			
PO-10	✓	✓	✓

**COURSE OUTCOME**  
**M.Sc. IV SEMESTER**  
**COURSE CODE : PD2**  
**PAPER CODE : 404**  
**PAPER : IV (DISSERTATION)**

**After completion of course the students will able to :-**

- CO1. Designing of research work.
- CO2. Formulation of research methodology.

**COURSE OUTCOME**

**M.Sc. IV SEMESTER**

**COURSE CODE : PD2**

**PAPER CODE : 405**

**PAPER : V (PHOTOINORGANIC CHEMISTRY )**

**After completion of course the students will able to :-**

CO1. Discribe type of photochemical & photosensitization reactions.

CO2.Explain the fundamental concept of photochemistry.

CO3.Acquire the knowledge of excited states of metal complex and semiconductors.

CO4.Understand the application of photochemical electron transfer in redox reactions.

CO5.Analyse and interpret photoeffects in coordination chemistry.

CO6.Explain physical and photochemical process for the excitation of the molecule.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1		✓			✓	
PO-2	✓		✓	✓		
PO-3			✓	✓		
PO-4						
PO-5						
PO-6						
PO-7						
PO-8	✓	✓			✓	✓
PO-9						
PO-10						✓



**COURSE OUTCOME**  
**M.Sc. IV SEMESTER**  
**COURSE CODE : PD2**  
**PAPER CODE : 406**

**PAPER : V (MATERIAL SCIENCE)**

**After completion of course the students will able to :-**

C01. Classify materials (crystals) according to their types .

C02. Understand the theories if metallic state.

C03. Describe crystal geometry technique of structure determination.

C04. Acquire knowledge of ionic conductors and organic semiconductors.

C05 Compare different liquid crystals.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1				✓	
PO-2		✓	✓		✓
PO-3	✓				
PO-4					
PO-5					
PO-6	✓		✓		✓
PO-7	✓				
PO-8		✓			✓
PO-9					
PO-10		✓		✓	

**COURSE OUTCOME**  
**M.Sc. IV SEMESTER**  
**COURSE CODE : PD2**  
**PAPER CODE : 407**

**PAPER : V (CHEMISTRY OF NATURAL  
PRODUCT)**

**After completion of course the students will able to :-**

- CO1. Knowledge of structure of nature product like tapenoids, alkaloids, steoids ,plantpigment.
- CO2. Able to describe various type of degradations reaction and synthesis of naturalproducts.
- CO3. Classify the terpenoids, alkaloids flavonoids and its application .
- CO4. Evaluate the importance of alkaloids in medicinal field.
- CO5. Analyse the methods applied in determination of different natural product.
- CO6. A research tendency to go for innovative study of organic chemistry in the lightof latest research insight.

	CO-1	CO-2	CO-3	CO-4	CO-5	
PO- 1				✓		✓
PO-2	✓	✓				
PO-3			✓			
PO-4		✓				
PO-5						
PO-6					✓	
PO-7						
PO-8	✓		✓			✓
PO-9						
PO-10				✓	✓	

