Shri Pragya Mahavidyalaya
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Program Outcome (PO's), Program Specific Outcomes (PSO's) and Course Outcome (CO's) for UG and PG Programs of Faculty of Science

DEPARTMENT OF SCIENCE

BACHELOR OF SCIENCE

Programme Outcomes

Department of Science	After successful completion of three year degree program in B.Sc. student should be able to
Programme Outcomes	1. **Comprehensive Knowledge**: Graduates will have a broad understanding of key concepts, theories, and principles within their specific scientific discipline. 2. **Fundamental Concepts**: In-depth knowledge of fundamental scientific concepts, methodologies, and approaches within their field. 3. **Research Skills**: Proficiency in designing, conducting, and interpreting scientific research and experiments. 4. **Problem-Solving**: Skills to identify, formulate, and solve complex scientific problems using appropriate techniques and tools. 5. **Collaboration**: Ability to work effectively in teams, demonstrating interpersonal skills and leadership where necessary. 6. **Practical Application**: Capability to apply theoretical knowledge to practical situations,including industry-specific scenarios and real-world problems. 7. **Interdisciplinary Integration**: Ability to integrate knowledge from various scientific disciplines to address complex questions and challenges. 8. **Ethical Awareness**: Understanding of professional and ethical responsibilities in scientific practice. 9. **Laboratory Skills** - Students should develop proficiency in laboratory techniques, including experimental design, data collection, analysis and interpretation, as well as proficiency in the use of relevant laboratory equipment and software.
Programme specific outcomes	1. **Scientific Knowledge and Application** - Graduates will demonstrate a strong grasp of fundamental concepts in their specific field of study, whether it be in the physical sciences, life sciences, or computational sciences. They will be capable of utilizing this knowledge to address and resolve practical and theoretical issues. 2. **Research and Analytical Skills** -- Graduates will be adept at formulating research questions, developing hypotheses, and designing experiments or studies to test these hypotheses. They will be skilled in using modern scientific equipment, software, and techniques to gather and analyse data. 3. **Communication and Ethical Understanding** -Graduates will be capable of conveying complex scientific concepts and findings clearly and concisely to both specialist and non- specialist audiences, through written reports, presentations, and discussions. They will also have a strong awareness of the ethical considerations in scientific research and practice.

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Course outcomes
Zoology

After successful completion of three year degree program in zoology student should be able to;

Paper No.	Paper Name
CC-I	**Diversity of animals and evolution**
CO-1	• To recall the key principles of evolution, including natural selection, genetic drift, and speciation.
CO-2	• To Explain how natural selection drives the process of evolution in variousanimal populations.
CO-3	• To apply evolutionary principles to analyze specific examples of adaptation and speciation in animal populations.
CO-4	• To Compare and contrast the evolutionary adaptations of different animal species in response to similar environmental pressures.
CO-5	• To Critically evaluate alternative hypotheses for evolutionary patterns and processes.
CO-6	• To Design an experiment to test a specific hypothesis related to animalevolution or adaptation.
CC-II	**Cell biology and Genetics**
CO-1	• To recall the basic structure and function of cell organelles, including the nucleus, mitochondria, endoplasmic reticulum, and Golgi apparatus.
CO-2	• To explain the molecular mechanisms of DNA replication, transcription, and translation.
CO-3	• To apply knowledge of cellular organelles and their functions to interpret experimental data or observations related to cell structure and function.
CO-4	• To analyze experimental data or case studies to identify the molecular mechanisms underlying genetic disorders.
CO-5	• To evaluate the significance of genetic variation in evolution and adaptation.
CO-6	• To Design an experiment to investigate a specific aspect of cell biology or genetics.
CC-III	**Developmental Biology**
CO-1	• To Recall the key stages of embryonic development in various organisms.
CO-2	• To Explain the principles of embryonic patterning and morphogenesis.

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CO-3	• To Apply knowledge of developmental processes to interpret experimental data orobservations related to embryonic development.
CO-4	• To Analyze experimental data or case studies to identify the molecular mechanisms underlying developmental disorders.
CO-5	• To Evaluate the impact of genetic and environmental factors on developmental outcomes.
CO-6	• To Design an experiment to investigate a specific aspect of developmental biology, such as tissue regeneration or organogenesis.
CC-IV	**Structure and Functions of Invertebrate Types**
CO-1	• To Recall the key characteristics of major invertebrate phyla, including anatomical features and habitat preferences.
CO-2	• ToExplain the adaptations of different invertebrate groups to their environments and lifestyles
CO-3	• ToApply knowledge of invertebrate anatomy and physiology to interpret observations or experimental data related to their structure and functions
CO-4	• ToAnalyze the structural adaptations of different invertebrate groups in relation to their evolutionary history and ecological niche
CO-5	• ToEvaluate the importance of invertebrates in various ecosystem services, including pollination, nutrient cycling, and decomposition
CO-6	• To Design an experiment to investigate a specific aspect of invertebrate biology, such as behaviour, physiology, or ecology.
CC-V	**Animal Physiology and Bio-chemistry**
CO-1	• To Recall the basic principles of cellular biology, including cell structure, organelle function, and cellular processes such as metabolism and signaling
CO-2	• To Explain the principles of homeostasis and how animals regulate internal conditions to maintain physiological balance
CO-3	• To Apply knowledge of animal physiology to interpret experimental data or observations related to physiological processes
CO-4	• To Analyze the functional adaptations of physiological systems in different animal species in relation to their evolutionary history and ecological niches
CO-5	• To Evaluate the impact of environmental factors, such as pollution or climate change, on animal physiology and health
CO-6	• To Design an experiment to investigate a specific aspect of animal physiology or biochemistry, such as hormone regulation, muscle contraction, or nutrient metabolism
CC-VI	**Immunology Microbiology and Bio Technology**
CO-1	• To Define the basic principles of immunology, microbiology, and biotechnology
CO -2	• To Explain the mechanisms of immune response to pathogens
CO-3	• To Apply immunological principles to analyze and solve problems related to diseases and immunity

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CO-4	• To Analyze experimental data related to immune responses, microbial growth, andbiotechnological processes
CO-5	• To Design experiments to investigate immune responses or microbial activities
CO-6	• To Assess the reliability and validity of scientific literature in the fields of immunology, microbiology, and biotechnology.
CC-VII	**Structure and Functions of Chordates**
CO-1	• To Define the characteristics of chordates and identify the key anatomical features associated with this phylum
CO -2	• To Interpret the functional significance of chordate characteristics in terms of evolutionary adaptations
CO-3	• To Apply knowledge of chordate anatomy to identify and classify different chordate species
CO-4	• To Analyze the structural and functional adaptations of specific chordate groups to their respective environments and ecological niches
CO-5	• To Design experiments to investigate the functional significance of specific chordate adaptations, such as the development of vertebrate appendages or the evolution ofneural crest cells
CO-6	• To Evaluate the validity of competing hypotheses regarding the evolutionary relationships among different chordate groups based on available evidence
CC-VIII	**Environmental Biology**
CO-1	• To Define the basic principles of environmental biology, including ecosystem dynamics, biodiversity, and ecological interactions
CO -2	• To Explain the interrelationships between living organisms and their environment,including biotic and abiotic factors
CO-3	• To Apply ecological principles to analyze and solve environmental problems, such as habitat degradation, species extinction, and pollution remediation.
CO-4	• To Analyze case studies of environmental issues to identify underlying causes, stakeholders, and potential solutions
CO-5	• To Design research projects to investigate specific environmental questions, such as the impacts of invasive species on native ecosystems or the effectiveness of conservationstrategies
CO-6	• To Evaluate the strengths and weaknesses of different methods for assessing ecological health and monitoring environmental change.
CC-IX	**Applied zoology , Ethology and Bio-statics**
CO-1	• To Define the principles of applied zoology and its relevance to various fields such as conservation biology, veterinary science, and agriculture
CO -2	• To Interpret the ecological and evolutionary implications of animal behavior in different habitats and ecological niches
CO-3	• To Apply knowledge of animal behavior to design and implement strategies for wildlife management, animal welfare, and conservation

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CO-4	• To Analyze patterns of animal behavior to infer underlying physiological, ecological, and evolutionary mechanisms
CO-5	• To Design research projects to investigate specific questions in applied zoology or ethology, incorporating appropriate experimental methodologies and statistical analyses
CO-6	• To Evaluate the ethical implications of human interventions in animal behavior and welfare, considering issues such as captivity, habitat alteration, and wildlife conservation

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Course Outcomes
Botany

After successful completion of three year degree program in Botany student should

Paper No.	Paper Name
CC-I	**Microbiology, Mycology and Phytopathology**
CO-1	• To recall the fundamental principles of microbiology, mycology, and phytopathology.
CO-2	• . ToExplain the principles underlying microbial growth, reproduction, and metabolism.
CO-3	• To Apply laboratory techniques for the isolation, cultivation, and identification of microorganisms and fungi.
CO-4	• To.Analyze experimental data related to microbial growth, fungal morphology, and plant-pathogen interactions.
CO-5	• To Assess the efficacy of different control measures for managing microbial and fungal diseases in crops.
CO-6	• To Design experiments to investigate specific aspects of microbial ecology, fungal biology, or plant-pathogen interactions.
CC-II	• **Algae, Lichens and Bryophyta**
CO-1	• To Recall the classification and diversity of algae, lichens, and bryophytes.
CO-2	• To Explain the morphological, physiological, and reproductive adaptations of algae, lichens, and bryophytes.
CO-3	• To Apply microscopy and laboratory techniques for the identification and classification of algae, lichens, and bryophytes.
CO-4	• To Analyze the structural and functional adaptations of algae, lichens, and bryophytes to diverse habitats.
CO-5	• To Assess the ecological impacts of anthropogenic stressors on algal, lichen, and bryophyte communities.
CO-6	• To Design experiments to investigate ecological interactions involving algae, lichens, and bryophytes in natural or experimental settings.

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CC-III	**Pteridophytes and Paleobotany**
CO-1	To Recognize the evolutionary significance of pteridophytes and paleobotanical specimens in the fossil record.
CO-2	To Summarize the evolutionary transitions between different plant groups, including the shift from pteridophytes to seed plants.
CO-3	To Utilize knowledge of pteridophyte biology to explain their roles in contemporary ecosystems and their importance as early land plants.
CO-4	To Evaluate paleobotanical evidence to investigate plant evolution, speciation events, and patterns of biodiversity over geological time scales.
CO-5	To Evaluate competing hypotheses and theories regarding the origin and diversification of pteridophytes and early land plants.
CO-6	To Develop paleobotanical research proposals to address unanswered questions about plant evolution, paleoecology, and biogeography.

CC-IV	**Diversity of Seed Plant**
CO-1	• To Memorize key morphological features and reproductive structures characteristic of different seed plant taxa.
CO-2	• To Interpret the ecological significance of different seed plant groups in terrestrial ecosystems.
CO-3	• To Apply botanical terminology and taxonomic keys to identify seed plant species and families.
CO-4	• To Evaluate the evolutionary innovations and diversification patterns within different seed plant lineages.
CO-5	• To Assess the ecological roles and ecosystem services provided by different groups of seed plants.
CO-6	• To Design field studies or experiments to investigate seed plant diversity, distribution patterns, and ecological interactions.
CC-V	**Systematics of Angiosperms**
CO-1	• To Recognize the diversity of angiosperms in terms of floral morphology, leaf arrangements, and growth habits.
CO-2	• To Explain the principles and methods of angiosperm systematics, including the use of morphological, anatomical, and molecular data for phylogenetic analysis.

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CO-3	• To Utilize systematic methods and software tools to analyze molecular and morphological data for phylogenetic reconstruction and species delimitation.
CO-4	• To Evaluate taxonomic characters and their evolutionary significance in resolving relationships among angiosperm taxa.
CO-5	• To Assess the reliability and robustness of phylogenetic hypotheses and systematic classifications of angiosperms.
CO-6	• To Design phylogenetic studies or taxonomic revisions to address unresolved questions and controversies in angiosperm systematics.
CC-VI	**Structure, Development and Reproduction in Flowering Plants**
CO-1	• To Memorize the processes involved in the development and growth of plant organs from meristems.
CO-2	• To Interpret the cellular processes involved in plant development, including cell division, differentiation, and tissue organization.
CO-3	• To Utilize microscopy techniques to observe and analyze the structure and development of plant cells and tissues.
CO-4	• To Analyze the structural adaptations of flowering plants in response to environmental cues and selective pressures.
CO-5	• To Assess the ecological and evolutionary significance of different reproductive strategies employed by flowering plants.
CO-6	• To Propose innovative research projects or interdisciplinary collaborations to address emerging questions in plant biology and botany.

CC-VII	**Plant Physiology and Biochemistry**
CO-1	• To recall the major physiological processes in plants, such as photosynthesis, respiration, transpiration, and nutrient uptake.
CO-2	• To Explain the mechanisms behind plant responses to environmental stimuli, such as light, temperature, and water availability.
CO-3	• To Apply knowledge of plant physiology and biochemistry to solve practical problems in agriculture, horticulture, or environmental science.

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CO-4	• To Analyze the interrelationships between different physiological processes andbiochemical pathways in plants.
CO-5	• To Assess the effectiveness of different strategies for improving crop yield, stress tolerance, or nutritional quality based on an understanding of plant physiology andbiochemistry.
CO-6	• To Develop innovative approaches for manipulating plant physiology and biochemistry to address challenges such as climate change, food security, or sustainable agriculture.
CC-VIII	**Cytology, Genetics and Biotechnology**
CO-1	• To Memorize the fundamental principles of classical genetics, including Mendel'slaws of inheritance and the structure of DNA.
CO-2	• To Explain the processes of cell division, including mitosis and meiosis, and theirsignificance in genetics and reproduction.
CO-3	• To Apply cytological techniques to study cell structure and function, such as microscopy, cell fractionation, and cell culture.
CO-4	• To Analyze genetic data using bioinformatics tools to identify genes, regulatoryelements, and genetic mutations.
CO-5	• To Evaluate the ethical implications of biotechnological applications such as geneticengineering, gene therapy, and cloning.
CO-6	• To Design experiments to investigate gene function, gene regulation, or geneticengineering techniques.
CC-IX	**Ecology and Utilization of Plant**
CO-1	• To Recall the basic principles of ecology, including ecosystems, biomes, and ecological interactions among organisms.
CO-2	• To Explain ecological concepts such as energy flow, nutrient cycling, and populationdynamics in plant communities.
CO-3	• To Apply ecological principles to analyze and solve environmental problems, such as habitat degradation, species conservation, and invasive species management.
CO-4	• To Analyze the impact of human activities on plant ecosystems, including deforestation, urbanization, pollution, and climate change.
CO-5	• To Evaluate the effectiveness of conservation strategies and policies aimed at preserving plant biodiversity and ecosystem services.
CO-6	• To Design research projects to investigate the ecology of specific plant communities,ecosystems, or ecological processes.

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COURSE OUTCOME
CHEMISTRY

After successful completion of three year degree programme in Chemistry a student should be able to

Paper No.	Paper Name
CC-I	**Inorganic Chemistry I : Atomic Structure & Chemical Bonding**
CO-1	• Recall the fundamental concepts of atomic structure, including the properties of subatomic particles and the organization of the periodic table.
CO-2	• Explain the relationship between atomic structure and the periodic properties of elements, such as atomic radius, ionization energy, and • electron affinity.
CO-3	• Apply knowledge of atomic structure to predict the electronic configurations of elements and ions.
CO-4	• Analyze Lewis structures and molecular geometries to predict the shapes and bond angles of molecules.
CO-5	• Evaluate the strength and stability of chemical bonds based on factors such as bond length, bond energy, and molecular structure
CO-6	• Design molecular models to illustrate the three-dimensional structures of molecules and polyatomic ions
CC-II	**Physical Chemistry I: States of Matter, Solution , Nuclear Chemistry**
CO-1	• Recall the fundamental principles of states of matter, including the behavior of gases, liquids, and solids under different conditions
CO-2	• Explain the gas laws and their application to real-world situations, such as the behavior of gases in chemical reactions or industrial processes
CO-3	• Apply the laws of thermodynamics to calculate changes in energy, entropy, and spontaneity for chemical processes involving gases, liquids,and solids
CO-4	• Analyze nuclear decay processes and their implications for nuclear stability and decay kinetics.
CO-5	• Evaluate the factors influencing the phase behavior of substances and their relevance to industrial processes and environmental phenomena
CO-6	• Design experiments to investigate the thermodynamic and kinetic properties of gases, liquids, and solids, as well as the behavior of solutions

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CC-III	Organic Chemistry I: Mechanism , Stereochemistry &Hydrocarbons
CO-1	• Recall the fundamental principles of organic chemistry, including the structure and bonding of carbon-containing compounds.
CO-2	• Explain the principles of reaction mechanisms, including electron flow, intermediates, and transition states.
CO-3	• Apply knowledge of reaction mechanisms to predict the products of organic reactions and propose reaction pathways.
CO-4	• Analyze the stereochemical outcome of organic reactions based on the configuration of reactants and reagents.
CO-5	• Evaluate the efficiency and selectivity of organic reaction pathways, considering factors such as yield, regioselectivity, and stereoselectivity
CO-6	• Design synthetic routes for the preparation of complex organic molecules, considering the principles of retrosynthetic analysis and functional group interconversions.
CC-IV	**Physical Chemistry II: Thermodynamics & Equilibrium & Electrochemistry**
CO-1	• Recall the laws of thermodynamics, including the first law (energy conservation), the second law (entropy), and the third law (absolute zero)
CO-2	• Understand the principles of electrochemistry, including redox reactions, electrode potentials, and electrolysis.
CO-3	• Apply thermodynamic principles to calculate changes in energy, entropy, and free energy for chemical reactions and phase transitions
CO-4	• Analyze thermodynamic data to determine the spontaneity and feasibility of chemical processes.
CO-5	• Evaluate the factors that influence chemical equilibrium and propose strategies for manipulating equilibrium conditions.
CO-6	• Design thermodynamic experiments to measure and analyze energy changes in chemical reactions and phase transitions.
CC-V	**Inorganic Chemistry II: d and f -Block elements , coordination compound**
CO-1	• Recall the properties and characteristics of d-block and f-block elements, including electronic configurations, oxidation states, and magneticproperties
CO-2	• Explain the electronic structure and chemical behavior of d-block and f- block elements, including their role as transition metals and lanthanides/actinides.
CO-3	• Apply knowledge of d-block and f-block chemistry to predict the properties and reactivity of transition metal compounds and coordinationcomplexes
CO-4	• Analyze the electronic spectra and magnetic properties of transition metal complexes to determine their coordination geometries andoxidation states.
CO-5	• Evaluate the factors influencing the stability and reactivity of coordination compounds, including ligand field effects, chelate effects, and steric hindrance.

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CC-VI	Organic Chemistry II: Electromagnetic spectrum , Alcohol , Phenol, Carboxylic acid, Nitrogen Containing compounds
CO-1	• Remember the characteristic reactions and functional group transformations of alcohols, phenols, carboxylic acids, and nitrogen- containing compound
CO-2	• Explain the principles of spectroscopic techniques and how they are used to identify and characterize organic compounds
CO-3	• Apply spectroscopic data interpretation techniques to analyze IR, UV- Vis, and NMR spectra and identify functional groups and structural features in organic molecules.
CO-4	• Analyze the reactivity patterns and selectivity of reactions involving alcohols, phenols, carboxylic acids, and nitrogen-containing compounds.
CO-5	• Evaluate the effectiveness and limitations of spectroscopic techniques for structural determination and compound identification, considering factors such as sensitivity, resolution, and spectral interpretation
CO-6	• Design experiments to investigate the properties and reactivity of alcohols, phenols, carboxylic acids, and nitrogen-containing compounds, including kinetic studies and mechanistic investigations.
CC-VII	**Physical Chemistry III: Chemical Kinetics and Quantum Chemistry & Spectroscopy**
CO-1	• Recall the basic concepts and definitions of chemical kinetics, including reaction rate, rate law, and reaction orde
CO-2	• Explain the factors that influence reaction rates, including temperature, concentration, and the presence of catalysts.
CO-3	• Apply mathematical models of chemical kinetics to analyze experimental data and determine rate constants and reaction mechanisms.
CO-4	• Analyze molecular electronic structure and spectroscopic data to interpret molecular properties and predict spectroscopic behavior
CO-5	• Evaluate the significance of rate constants and reaction mechanisms in chemical processes, considering their implications for reaction kinetics and reaction pathways.
CO-6	• Design spectroscopic experiments to probe molecular structure and dynamics in complex chemical systems, such as biological molecules or reaction intermediates.
CC-VIII	**Inorganic Chemistry III: : Transition metal complex and Organometallic & Bioinorganic Chemistry**
CO-1	• Recall the role of metal ions in biological systems, including metalloenzymes, metalloproteins, and metallocofactors.
CO-2	• Explain the electronic structure and bonding in transition metal complexes, including the crystal field theory, ligand field theory, and molecular orbital theory.
CO-3	• Apply spectroscopic techniques to characterize transition metal complexes and determine their electronic and geometric structures.

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CO-4	• Analyze the electronic spectra and magnetic properties of transition metal complexes to determine their coordination geometries, oxidation states, and electronic configurations
CO-5	• Evaluate the catalytic efficiency and selectivity of transition metal complexes in homogeneous and heterogeneous catalysis, considering factors such as ligand design, reaction conditions, and substrate scope
CO-6	• Design experiments to investigate the structure and function of metalloenzymes and metalloproteins, including site-directed mutagenesis studies and spectroscopic characterization.

CC-IX	**Organic Chemistry- III : Spectroscopy and Heterocyclic and carbohydrate , polymer Chemistry**
CO-1	• Recall the basic principles and techniques of spectroscopic methods used in organic chemistry, including infrared (IR), nuclear magnetic resonance (NMR), and mass spectrometry (MS)
CO-2	• Explain the principles and instrumentation of spectroscopic methods used for structural elucidation and analysis in organic chemistry.
CO-3	• Apply spectroscopic data interpretation techniques to analyze experimental spectra and determine the structures of organic molecules.
CO-4	• Analyze the reactivity patterns and synthetic methods of heterocyclic compounds, carbohydrates, and polymers to predict the outcomes of organic reactions.
CO-5	• Evaluate the reliability and limitations of spectroscopic techniques for structural determination and compound identification in organic chemistry.
CO-6	• Design synthetic routes for the preparation of heterocyclic compounds and carbohydrates with specific functionalities and stereochemical configurations.

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COURSE OUTCOME

MATHS

Paper No.	Paper Name
CC-I	**Number theory and theory of equation**
CO-1	• Demonstrate a comprehensive understanding of fundamental concepts in number theory, including prime numbers, divisibility, congruences, and arithmetic functions
CO-2	• Analyze the properties of various number systems, including integers, rational numbers, real numbers, and complex numbers, and their applications in mathematical contexts
CO-3	• Evaluate the significance of number theory in other branches of mathematics, such as algebra, geometry, and analysis.
CO-4	• Illustrate proficiency in solving Diophantine equations and exploring their applications in mathematical modeling and problem-solving
CO-5	• Explore advanced topics in the theory of equations, such as Galois theory, symmetric functions, and algebraic geometry, and their applications in mathematics and related fields.
CO-6	• Synthesize knowledge from number theory and the theory of equations to solve complex mathematical problems and formulate conjectures.
CC-II	**Calculs**
CO-1	• Demonstrate a solid understanding of fundamental concepts in differential calculus, including limits, continuity, derivatives, and their applications.
CO-2	• Analyze the geometric interpretation of derivatives, including the slope of curves, rates of change, concavity, and optimization problems.
CO-3	• Utilize differentiation to solve problems in related rates, curve sketching, optimization, and linear approximation.
CO-4	• Investigate the concept of integration and its relationship to antiderivatives, definite integrals, and Riemann sums
CO-5	• Investigate the concept of integration and its relationship to antiderivatives, definite integrals, and Riemann sums
CO-6	• Synthesize knowledge from differential and integral calculus to solve problems in optimization, related rates, and modeling real-world phenomena.
CC-III	**Vector calcus and 3 D Geometry**
CO-1	• Demonstrate a thorough understanding of fundamental concepts in vector calculus, including vectors, vector operations (such as addition, subtraction, scalar multiplication, dot product, and cross product), vector-valued functions, and vector fields.
CO-2	• Apply vector calculus techniques to analyze and solve problems related to curves and surfaces in three-dimensional space, including parametric equations, arc length, curvature, and torsion.
CO-3	• Utilize vector calculus methods to study and analyze vector fields, including gradient, divergence, curl, and Laplacian, and their applications in physics, engineering, and other scientific disciplines.

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CO-4	• Investigate line integrals, surface integrals, and volume integrals, including their interpretations in terms of flux, circulation, work, and applications in physics (such as Gauss's Law and Stokes' Theorem).
CO-5	• Explore 3D geometry concepts, including equations of lines and planes in three-dimensional space, distance between points and between a point and a line/plane, and angles between lines and planes.
CO-6	• Investigate the properties of 3D shapes, including spheres, cylinders, cones, and quadric surfaces, and analyze their equations, intersections, and geometric properties
CC-IV	**Group theory and ring theory**
CO-1	• Demonstrate a solid understanding of fundamental concepts in group theory, including groups, subgroups, group operations, group axioms, and group isomorphisms.
CO-2	• Apply group theory techniques to analyze and solve problems related to symmetry, group actions, and permutation groups, including applications in geometry, chemistry, and cryptography.
CO-3	• : Explore the concepts of group homomorphisms, kernels, images, normal subgroups, and factor groups, and their significance in understanding group structure and quotient structures.
CO-4	• Demonstrate proficiency in ring theory, including rings, ideals, ring homomorphisms, quotient rings, integral domains, fields, and polynomial rings.
CO-5	• Analyze the properties of specific types of rings, such as commutative rings, Euclidean domains, principal ideal domains, and unique factorization domains, and their applications in algebra and cryptography.
CO-6	• Investigate ring theory concepts related to polynomial rings, including irreducibility, factorization, and field extensions, and their connections to algebraic geometry and number theory.

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CC-V	Differential equation
CO-1	• Students should be able to understand what a differential equation is, its significance in modeling real-world phenomena, and the various types of differential equations.
CO-2	• Students should be proficient in solving different types of differential equations, including first-order ordinary differential equations, linear differential equations, and systems of differential equations.
CO-3	• Students should be familiar with analytical techniques for solving differenti equations, such as separation of variables, integrating factors. substitutic methods, and power series solutions
CO-4	• Students should be able to apply differential equations to solve problems various fields, including physics, engineering, biology, chemistry, economic and ecology.
CO-5	• Students should understand the connection between theoretical concepts of differential equations and their practical applications, and be able to apply theoretical knowledge to real-world problems
CC-VI	Real Analysis
CO-1	• Students should develop a deep understanding of the real number system. including properties such as completeness, density, and order
CO-2	• Students should be able to work with sequences and series of real numbe understand convergence and divergence criteria, and analyze the behavior sequences and series using techniques such as limit theorems and converger tests
CO-3	• Students should understand the concept of limits of functions and be able to analyze the continuity of functions, including the properties of continuous functions and the intermediate value theorem.
CO-4	• Students should understand the concept of differentiation and be able compute derivatives of functions using limit definitions, rules of differentiation, and techniques such as implicit differentiation and logarithr differentiation...
CO-5	• Students should be able to apply the concepts and techniques of real analysi to solve problems in various areas of mathematics, including calculus differential equations, functional analysis, and probability theory.
CC-VII	Complex Analysis
CO-1	• Students should develop a deep understanding of complex numbers including their algebraic properties, representation in the complex plane, an operations such as addition, subtraction, multiplication, division, and exponentiation
CO-2	• Students should understand the concept of analytic functions and be able to analyze properties of analytic functions, including differentiability, the Cauchy-Riemann equations, and harmonic functions.
CO-3	• Students should be able to compute integrals of complex-valued functions along curves in the complex plane, understand concepts such as contour integration Cauchy's integral theorem, Cauchy's integral formula, and the residue theorem.

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CO-4	• Students should understand the concept of conformal mapping and be able t analyze properties of conformal mappings, including preserving angle conformal equivalence, and applications such as mapping between regions i the complex plane.
CO-5	• Students should be able to compute derivatives of complex-valued function using the Cauchy-Riemann equations and techniques such as the Wirtinge derivatives, and understand the behavior of derivatives near singular points
CO-6	• Students should understand the concept of residues of complex functions an be able to compute residues, evaluate contour integrals using the residu theorem, and apply residues to compute real integrals and sums of series
CC-VIII	**Numerical Analysis and C Programming**
CO-1	• Students should develop a deep understanding of fundamental numeri methods for solving mathematical problems, including root finding, numeric integration, interpolation, numerical differentiation, and solving differen equations.
CO-2	• Students should be able to implement numerical algorithms in the programming language, including writing functions, handling data types, an managing memory allocation.
CO-3	• Students should be able to perform basic linear algebra computations in C. including matrix operations, solving linear systems of equations, eigenvalue/eigenvector calculations, and singular value decomposition
CO-4	• Students should be able to solve ordinary and partial differential equation numerically using techniques such as Euler's method. Runge-Kutta methods finite difference methods, finite element methods, and spectral methods
CO-5	• Students should be able to integrate numerical algorithms with existing C libraries and APIs for mathematical computation, visualization, and data manipulation.
CO-6	• Students should be able to document their code effectively, including writin comments, providing function headers, and creating user documentation fo numerical algorithms implemented in C
CC-IX	**Dynamics and Statics**
CO-1	• Students should be able to analyze and resolve forces acting on objects in tv and three dimensions, including concurrent, coplanar, and non- concurre force systems, using vectorial techniques
CO-2	• Students should understand the concept of static equilibrium for particles ar rigid bodies, including the conditions required for an object to be equilibrium under the action of external forces and moments.
CO-3	• Students should understand the principles of friction and be able to analyz problems involving dry friction, including the calculation of frictional force and moments

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CO-4	• Students should understand Newton's laws of motion and be able to apply them to analyze the motion of objects under the action of external forces. including inertial and non-inertial reference frames.
CO-5	• Students should understand the concepts of work, kinetic energy, potential energy, and conservation of mechanical energy, and be able to apply these concepts to analyze the motion of objects and systems.
CO-6	• Students should be able to apply principles of dynamics to solve problems i various fields such as mechanical engineering, aerospace engineering robotics, and vehicle dynamics

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MASTER OF SCIENCE

PROGRAMME OUTCOME

Department of SCIENCE	After successful completion of two year Master degree programme in Science a student should be able to :
Programme outcome	1 **Advanced Knowledge and Understanding**: • Develop a deep understanding of the theoretical and practical aspects of the specific field of study. • Gain expertise in advanced concepts, methodologies, and techniques relevant to the discipline. 2 **Research Skills**: • Acquire the ability to design, conduct, and analyze original research. • Develop skills in applying appropriate research methodologies and techniques. • Learn to critically evaluate and synthesize research literature. 3 **Problem-Solving and Critical Thinking**: • Enhance problem-solving abilities and critical thinking skills. • Learn to apply knowledge to identify, analyze, and solve complex problems within the field. 4 **Technical and Analytical Skills**: • Gain proficiency in using advanced tools, technologies, and software relevant to the discipline. • Develop strong analytical skills to interpret data and derive meaningful insights. 5 **Communication Skills**: • Improve written and oral communication skills, particularly in conveying complex concepts and research findings to both specialized and general audiences. • Learn to present research findings effectively through reports, presentations, and publications. 6 **Ethical and Professional Conduct**: • Understand and adhere to ethical standards and practices in research and profession activities. • Develop a sense of responsibility and professionalism in the conduct of work. 7 **Specialized Expertise**: • Achieve specialized knowledge and skills tailored to the specific subfield or concentration within the MSc program. • Gain hands-on experience through projects, internships, or laboratory work. 8 **Global and Societal Impact**:

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MASTER OF SCIENCE
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	• Understand the broader implications of the field on society and the environment. • Develop awareness of global trends and challenges related to the discipline.

Programme Specific Outcomes	1 **Advanced Knowledge and Understanding**: Gain advanced theoretical and practical knowledge in the specialized area of "Three Point," encompassing key concepts, principles, and methodologies. 2 **Analytical and Research Skills**: Develop proficiency in conducting in-depth analysis ar research relevant to "Three Point," including data collection, interpretation, and applicatic of findings. 3 **Innovative Problem-Solving**: Demonstrate the ability to creatively and innovatively sol complex problems within the context of "Three Point," integrating interdisciplina knowledge where applicable.

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Course Outcomes

PHYSICS

Paper No.	Paper Name
CC - I	**Classical Mechanics**
CO-1	• Define fundamental concepts in classical mechanics such as velocity, acceleration, force, mass, and Newton's laws.
CO-2	• Explain the relationship between force, mass, and acceleration using Newton's second law. Interpret and analyze graphs depicting motion, velocity, and acceleration.
CO-3	• Solve problems involving motion in one and two dimensions using equations of motion. Apply Newton's laws to analyze forces and motion in various scenarios, such as inclined planes, pulleys, and projectiles.
CO-4	• Break down complex physical systems into simpler components to analyze forces and motion.
CO-5	• Assess the validity and limitations of classical mechanics in explaining physical phenomena at different scales, from macroscopic to microscopic..
CC - II	**Classical Electrodynamics - 1**
CO-1	• Recall Maxwell's equations and their significance in describing electromagnetic phenomena.
CO-2	• Explain the physical principles behind Gauss's law, Ampère's law, and Faraday's law..
CO-3	• Solve problems involving the calculation of electric and magnetic fields due to point charges, line charges, and current-carrying wires.
CO-4	• Break down complex electromagnetic systems into simpler components to analyze their behavior.
CO-5	• Assess the applicability of classical electrodynamics principles in explaining various physical phenomena, including optics, electricity, and magnetism.
CC-III	**Quantum Mechanics**
CO-1	• Recall the fundamental postulates of quantum mechanics, including wave-particle duality and the uncertainty principle.
CO-2	• Explain the mathematical formalism of quantum mechanics, including the Schrödinger equation and its interpretation.
CO-3	• Solve problems involving one-dimensional and three-dimensional quantum systems, such as particle in a box, harmonic oscillator, and hydrogen atom.
CO-4	• Break down complex quantum systems into simpler components to analyze their behavior.
CO-5	• Assess the predictive power of quantum mechanics in explaining experimental observations across various physical systems, from atomic and molecular scales to condensed matter and beyond.
CC-IV	**Mathematical Methods in Physics**
CO-1	• Recall fundamental mathematical concepts used in physics, such as calculus, linear algebra, and differential equations.
CO-2	• Explain the mathematical techniques used to solve physical problems, such as Fourier analysis, complex analysis, and vector calculus.
CO-3	• Apply mathematical methods to solve problems in classical mechanics, including

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	motion of particles, rigid bodies, and oscillatory systems.
CO-4	• Analyze the behavior of physical systems using mathematical models and equations, identifying key parameters and dependencies.
CO-5	• Evaluate the effectiveness of mathematical methods in describing and predicting physical phenomena across different scales and contexts.
CC-V	**Classical Electrodynamics (II)**
CO-1	• Understand the behavior of electric and magnetic fields in various situations, including in vacuum, dielectrics, and conductors. • Interpret the concepts of electric potential, electric field lines, magnetic flux, and electromagnetic waves.
CO-2	• Use vector calculus techniques to solve problems related to electric and magnetic fields, including gradient, divergence, and curl operations.
CO-3	• Analyze the effects of boundary conditions and symmetry on the solutions of Maxwell's equations.
CO-4	• Evaluate the applicability and limitations of classical electrodynamics in describing electromagnetic phenomena at different scales, from macroscopic to microscopic.
CO-5	• Design experiments to investigate specific aspects of electromagnetic phenomena and test theoretical predictions.
CC-VI	**Atomic and Molecular Physics**
CO-1	• Recall the basic principles of quantum mechanics as applied to atomic and molecular systems.
CO-2	• Understand the principles of atomic and molecular spectroscopy, including absorption, emission, and scattering phenomena.
CO-3	• Apply quantum mechanical models to calculate atomic and molecular energy levels and transition probabilities.
CO-4	• Analyze atomic and molecular spectra to determine energy level structure, electronic transitions, and molecular properties.
CO-5	• Evaluate the accuracy and reliability of theoretical models and computational methods in predicting atomic and molecular properties.
CC-VII	**Electronics**
CO-1	• Recall the basic principles of electronics, including Ohm's law, Kirchhoff's laws, and circuit analysis techniques.
CO-2	• Understand the behavior of electronic components under different operating conditions, including DC and AC circuits.
CO-3	• Apply circuit analysis techniques to solve problems involving DC and AC circuits, including voltage, current, and power calculations.
CO-4	• Analyze the behavior of electronic circuits using mathematical models and circuit simulation tools.
CO-5	• Evaluate the performance and functionality of electronic circuits based on specified criteria, such as gain, bandwidth, distortion, and efficiency.
CC-VIII	**Numerical Methods and Computer Programming**
CO-1	• Recall the fundamental principles of numerical methods, including interpolation, numerical integration, and root-finding algorithms.

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CO-2	• Understand the numerical algorithms used to solve mathematical problems, including their underlying principles and limitations.
CO-3	• Apply numerical methods to solve mathematical problems such as finding roots of equations, solving linear systems, and computing derivatives and integrals.
CO-4	• Analyze the convergence and stability properties of numerical algorithms under different conditions and parameter choices.
CO-5	• Evaluate the appropriateness of different numerical methods for solving specific mathematical problems, considering factors such as accuracy, efficiency, and implementation complexity.
CC-IX	**Nuclear physics -I**
CO-1	• Recall the basic concepts of nuclear structure and properties, including isotopes, isotones, and isobars.
CO-2	• Understand the principles of nuclear models, such as the liquid drop model and the shell model, and their applications in describing nuclear structure.
CO-3	• Apply nuclear models and theories to calculate nuclear properties such as binding energies, nuclear radii, and decay lifetimes.
CO-4	• Analyze nuclear data to extract information about nuclear structure, including spin-parity assignments, energy levels, and decay modes.
CO-5	• Evaluate the applicability of different nuclear models in describing experimental observations across various isotopes and nuclear systems.
CC-X	**Statistical and Solid State Physics**
CO-1	• Recall fundamental principles of statistical mechanics and solid state physics.
CO-2	• Explain the underlying principles governing statistical mechanics and solid state physics phenomena.
CO-3	• Apply statistical methods to analyze thermodynamic properties of systems, such as heat capacities and phase transitions.
CO-4	• Analyze experimental data using statistical techniques to draw conclusions about physical systems.
CO-5	• Critically evaluate theoretical models and experimental results in the context of statistical mechanics and solid state physics.
CC-XI	**Advanced Quantum Mechanics I**
CO-1	• Recall the fundamental postulates of quantum mechanics, including wave-particle duality and the uncertainty principle.
CO-2	• Explain the principles of quantum mechanics and their implications for the behavior of particles and systems.
CO-3	• Apply quantum mechanical principles to solve problems involving one-dimensional and multi-dimensional systems.
CO-4	• Analyze experimental data and theoretical models to understand the behavior of quantum systems.
CO-5	• Evaluate the validity and limitations of various interpretations of quantum mechanics, such as the Copenhagen interpretation and many-worlds interpretation.

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CC-XII	Microwave Electronics
CO-1	• Recall the basic principles of electromagnetism relevant to microwave electronics, including Maxwell's equations and wave propagation.
CO-2	• Explain the behavior of electromagnetic waves in microwave frequency regimes.
CO-3	• Apply microwave engineering principles to design and analyze passive components like filters and couplers.
CO-4	• Analyze the performance of microwave systems and circuits using concepts from electromagnetics and circuit theory.
CO-5	• Evaluate the performance of microwave circuits and systems based on design specifications and requirements.
CC-XIII	**Nuclear Physics II**
CO-1	• Recall the fundamental concepts of nuclear physics, including nuclear structure, nuclear reactions, and radioactive decay.
CO-2	• Explain the structure of atomic nuclei and the forces that bind nucleons together.
CO-3	• Apply nuclear physics principles to analyze experimental data and interpret nuclear phenomena.
CO-4	• Analyze the properties and behavior of atomic nuclei using theoretical models and experimental data.
CO-5	• Evaluate the strengths and limitations of different nuclear models in explaining experimental data.
CC-XIV	**Solid State Physics**
CO-1	• Recall the fundamental concepts of solid state physics, such as crystal structure, lattice vibrations, and electronic band theory.
CO-2	• Describe the behavior of electrons in periodic potentials and how it leads to the formation of energy bands in solids.
CO-3	• Apply solid state physics principles to analyze and predict the properties of materials under different conditions, such as temperature and pressure.
CO-4	• Analyze the structure-property relationships in solid materials to understand how microscopic properties influence macroscopic behavior.
CO-5	• Evaluate the validity of different theoretical models and computational methods used in solid state physics.
CC-XV	**Advanced Quantum Mechanics II**
CO-1	• Recall the foundational principles of quantum mechanics, including wave-particle duality, Heisenberg's uncertainty principle, and the Schrödinger equation.
CO-2	• Explain advanced concepts in quantum mechanics, such as quantum entanglement, quantum measurement theory, and quantum field theory.
CO-3	• Apply advanced quantum mechanics principles to analyze and solve problems involving complex quantum systems.
CO-4	• Analyze the behavior of quantum systems in different physical scenarios, including bound states, scattering processes, and quantum field interactions.

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CO-5	• Evaluate the strengths and weaknesses of different interpretations of quantum mechanics, such as the Copenhagen interpretation, many-worlds interpretation, and pilot-wave theory.
CC - XVI	**Microwave Electronics**
CO-1	• Recall the fundamental concepts of microwave engineering, including wave propagation, transmission lines, and microwave components.
CO-2	• Explain advanced concepts in microwave engineering, such as microwave network theory, impedance matching, and microwave system design.
CO-3	• Apply advanced microwave engineering principles to design and analyze microwave circuits and systems for specific applications.
CO-4	• Analyze the performance of microwave circuits and systems using theoretical models and simulation results.
CO-5	• Evaluate the advantages and limitations of different microwave circuit topologies and design approaches for specific applications.

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Course Outcomes

CHEMISTRY

After successful completion of two year degree programme in Chemistry a student should be able to :

Paper -No.	Paper Name
CC - I	**Inorganic Chemistry**
CO-1	• Recall and identify fundamental principles, concepts, and theories in inorganic chemistry.
CO-2	• Interpret the behavior of inorganic compounds based on their electronic structure and molecular geometry.
CO-3	• Apply theoretical knowledge to predict the outcomes of chemical reactions involving inorganic compounds.
CO-4	• Analyze experimental data to draw conclusions about the properties and behavior of inorganic compounds.
CO-5	• Critically assess research articles, experimental procedures, and scientific literature related to inorganic chemistry.
CO-6	• Design and propose novel synthetic strategies for the preparation of new inorganic materia with specific properties.
CC – II	**Reaction mechanism**
CO-1	• Recall key terminology, principles, and concepts related to reaction mechanisms.
CO-2	• Interpret the mechanisms of various organic reactions, including substitution, elimination, addition, and rearrangement reactions.
CO-3	• Apply mechanistic principles to predict the outcomes of organic reactions under different conditions.
CO-4	• Analyze experimental data and kinetic studies to deduce mechanisms and rate laws for organic reactions
CO-5	• Critically assess the limitations and assumptions of mechanistic proposals in the literature.
CO-6	• Develop hypotheses and experimental plans to investigate unanswered questions in organi reaction mechanisms.
CC-III	**Physical Chemistry**
CO-1	• Recall fundamental principles, laws, and theories in physical chemistry, including thermodynamics, kinetics, and quantum mechanics.
CO-2	• Interpret the behavior of chemical systems based on thermodynamic principles, including entropy, enthalpy, and Gibbs free energy.
CO-3	• Apply mathematical and computational methods to solve problems in physical chemistry, including equilibrium calculations, rate laws, and quantum mechanical models.
CO-4	• Analyze experimental data to extract thermodynamic and kinetic parameters, such as equilibrium constants, reaction rates, and activation energies.
CO-5	• Judge the reliability and accuracy of experimental results and theoretical predictions, considering sources of error and uncertainty.
CO-6	• Design experiments to explore the relationship between structure and properties in chemic systems.
CC-IV	**Computer and diffraction method**
CO-1	• Understand the mathematical and physical principles underlying diffraction phenomena.
CO-2	• Acquire a strong foundation in computer science concepts, including algorithms, data structures, and programming languages.

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CO-3	• Explore the intersection of computer science and diffraction methods, understanding how computational approaches enhance diffraction analysis.
CO-4	• Gain hands-on experience with various diffraction techniques, including crystallography, powder diffraction, and electron diffraction.
CO-5	• Develop proficiency in interpreting diffraction patterns and extracting meaningful information about the structure and properties of materials.
CO-6	• Explore advanced computational methods for diffraction analysis, including machine learning, image processing, and simulation techniques.
CC-V	**Coordination chemistry**
CO-1	• Develop a comprehensive understanding of coordination chemistry principles, including ligand field theory, symmetry, and molecular orbital theory.
CO-2	• Learn various synthesis methods for preparing coordination compounds, including classica and modern approaches.
CO-3	• Analyze the structures of coordination compounds and understand the factors influencing coordination geometries and metal-ligand bonding.
CO-4	• Explore the reactivity of coordination compounds, including substitution, redox, and catalytic reactions.
CO-5	• Explore the role of coordination compounds as catalysts in various chemical transformations, including homogeneous and heterogeneous catalysis.
CO-6	• Delve into advanced topics in coordination chemistry, such as supramolecular chemistry, bioinorganic chemistry, and metal-organic frameworks.
CC-VI	**Reaction mechanism-II and Stereochemistry**
CO-1	• Demonstrate a deep understanding of complex organic reaction mechanisms, including pericyclic reactions, radical reactions, and rearrangements.
CO-2	• Explain the principles of stereochemistry, including chirality, stereoisomerism, and conformational analysis.
CO-3	• Understand the significance of chirality in organic molecules and its implications for biological activity and asymmetric synthesis.
CO-4	• Investigate the stereochemical outcomes of organic reactions, including stereoselectivity, stereospecificity, and kinetic versus thermodynamic control.
CO-5	• Perform conformational analysis of organic molecules, including cyclic compounds and substituted alkanes.
CO-6	• Explore the role of stereochemistry in drug design, bioactivity, and molecular recognition processes.
CC-VII	**Physical chemistry – II**
CO-1	• Demonstrate an advanced understanding of thermodynamic concepts beyond the undergraduate level, including non-ideal behavior, phase equilibria, and statistical thermodynamics.
CO-2	• Explore advanced topics in chemical kinetics, including reaction mechanisms, theories of reaction rates, and transition state theory.
CO-3	• Interpret molecular spectra using quantum mechanical models and spectroscopic technique including rotational, vibrational, and electronic spectroscopy.
CO-4	• Investigate electrochemical phenomena at the molecular level, including electrode kinetics double layer structure, and electrocatalysis.
CO-5	• Gain proficiency in computational methods for modeling molecular structures, electronic properties, and reaction mechanisms.

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CO-6	• Explore the application of physical chemistry principles in materials science, nanotechnology, and surface chemistry.
CC-VIII	**Group theory and spectroscopy**
CO-1	• Apply group theory principles to analyze molecular symmetry and predict the symmetry properties of molecules and their vibrational mode
CO-2	• Understand the application of group theory in the interpretation of spectroscopic data, including infrared (IR), Raman, electronic, and vibrational spectroscopy.
CO-3	• Analyze Raman and IR spectra using group theory to identify functional groups, molecular vibrations, and structural motifs.
CO-4	• Investigate electronic spectroscopy techniques, including UV-visible absorption, fluorescence, and phosphorescence spectroscopy.
CO-5	• Gain insights into NMR spectroscopy principles, including chemical shift, spin-spin coupling, and relaxation processes.
CO-6	• Explore advanced spectroscopic techniques, such as photoelectron spectroscopy (PES), X-ray spectroscopy, and mass spectrometry.
CC-IX	**Spectroscopy**
CO-1	• Differentiate between different spectroscopic methods based on their principles and applications.
CO-2	• Learn to identify functional groups, chemical shifts, coupling patterns, and other relevant spectral features.
CO-3	• Apply quantitative analysis techniques to determine concentrations, reaction kinetics, and other quantitative parameters.
CO-4	• Explore advanced spectroscopic methods and their applications
CO-5	• Explore the wide-ranging applications of spectroscopy in chemistry, biochemistry, materia science, environmental science, and other related fields.
CO-6	• Gain proficiency in using spectroscopic data processing and interpretation software
CC-X	**Photochemistry and solid state chemistry**
CO-1	• Develop a comprehensive understanding of the principles and mechanisms of photochemic reactions, including absorption of light, excited state dynamics, and photo physical processes
CO-2	• Analyze and predict the outcomes of photochemical reactions based on the electronic structure of molecules, energy levels, and reaction kinetics.
CO-3	• Investigate the applications of photochemistry in organic synthesis, photo voltaics, photo catalysis, and photom edicine.
CO-4	• Gain a solid understanding of solid state chemistry, including crystal structure, lattice dynamics, and defects in solids.
CO-5	• Learn experimental techniques for characterizing solid state materials, including X-ray diffraction (XRD), electron microscopy, and spectroscopic methods.
CO-6	• Enhance research skills through literature review, experimental design, data interpretation, and scientific communication.
CC-XI	**Environmental chemistry**
CO-1	• Develop a deep understanding of the fundamental principles and concepts of environmenta chemistry, including the behavior and fate of chemicals in natural systems.

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CO-2	• Acquire proficiency in chemical analysis techniques used for monitoring pollutants in various environmental matrices, including air, water, soil, and biota.
CO-3	• Identify sources of environmental pollutants and understand their pathways, transport mechanisms, and ecological impacts.
CO-4	• Explore the principles of environmental toxicology and risk assessment, including dose-response relationships, hazard identification, and exposure assessment.
CO-5	• Understand the chemistry of water pollutants, such as heavy metals, pesticides, nutrients, and emerging contaminants.
CO-6	• Examine environmental legislation, regulations, and international agreements governing chemical pollutants, waste management, and environmental protection.
CC-XII	**Chemistry of Life**
CO-1	• Develop a deep understanding of the molecular components and processes that underpin life, including bio molecules such as proteins, nucleic acids, lipids, and carbohydrates.
CO-2	• Investigate biochemical pathways involved in energy production, biosynthesis, and cellular regulation, such as glycolysis, Krebs cycle, and oxidative phosphorylation.
CO-3	• Explore the principles of enzyme structure, function, and catalysis, including enzyme kinetics, enzyme regulation, and enzyme mechanisms.
CO-4	• Gain insight into the structure and function of nucleic acids, including DNA, RNA, and their role in genetic information storage, replication, transcription, and translation.
CO-5	• Investigate the structure, folding, and stability of proteins, including primary, secondary, tertiary, and quaternary structure.
CO-6	• Examine cellular signaling mechanisms involved in cell-cell communication, signal transduction, and cellular response to external stimuli.
CC-XIII	**Organic synthesis –I**
CO-1	• Develop a thorough understanding of the fundamental principles and strategies of organic synthesis, including retro synthetic analysis, functional group inter conversions, and stereo chemical control.
CO-2	• Apply retro synthetic strategies to complex organic molecules and natural products, breaking down target molecules into simpler precursors.
CO-3	• Understand the reactivity and selectivity of different functional groups and reactive intermediates in organic synthesis.
CO-4	• Learn to choose appropriate protecting groups to control reactivity and prevent unwanted side reactions in multi-step synthesis.
CO-5	• Gain hands-on experience in organic synthesis through laboratory experiments and practical exercises.
CO-6	• Study classic total synthesis examples and seminal works in the field of organic synthesis, including landmark achievements in natural product synthesis.
CC-XIV	**Organic synthesis –II**
CO-1	• Develop expertise in complex retro synthetic analysis, including the disconnection of multiple bonds, strategic functional group transformations, and the retro synthetic analysis of natural products and biologically active compounds.
CO-2	• Explore advanced synthetic transformations and methodologies for the construction of complex molecular architectures, such as transition metal-catalyzed reactions, organo catalysis, and radical reactions.
CO-3	• Gain proficiency in asymmetric synthesis techniques and the use of chiral catalysts and auxiliaries for the preparation of enantio enriched compounds.
CO-4	• Design and carry out multi-step total synthesis projects targeting challenging natural products or biologically relevant compounds.

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CO-5	• Investigate the application of sustainable synthetic methodologies to complex molecule synthesis and the development of new synthetic strategies.
CO-6	• Enhance research skills through independent study, literature review, and laboratory investigations in organic synthesis.
CC – XIV	**Heterocycles chemistry**
CO-1	• Recall the properties and reactivity patterns of different classes of heterocyclic compounds
CO-2	• Explain the principles of aromaticity and its significance in heterocyclic chemistry.
CO-3	• Apply synthetic strategies to design routes for the synthesis of specific heterocyclic compounds.
CO-4	• Analyze the structure-activity relationships of bioactive heterocyclic compounds.
CO-5	• Synthesize novel heterocyclic compounds with desired structural and functional properties
CO-6	• Evaluate the advantages and limitations of different synthetic methodologies for heterocyclic synthesis.
CC – XVI	**Natural Product**
CO-1	• Recall the chemical structures, biosynthetic precursors, and biological activities of selected natural products.
CO-2	• Explain the biosynthetic pathways and enzymatic mechanisms involved in the biosynthesis of natural products.
CO-3	• Apply spectroscopic and chromatographic methods to analyze and identify natural products in complex mixtures.
CO-4	• Analyze the chemical diversity and structural motifs present in different classes of natural products.
CO-5	• Design synthetic strategies for the preparation of natural product analogs and derivatives with improved potency or selectivity.
CO-6	• Evaluate the sustainability and ecological impact of natural product isolation and extraction methods.

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