

Department of Chemistry

Program Outcomes, Course Outcomes & Proposed Activity Calendar

(B.Sc. I, II & III)

Program Outcomes (POs)

The B.Sc. programme in Chemistry aims to develop students' fundamental understanding of chemical sciences and their applications in everyday life, industry, healthcare, agriculture, and environmental sustainability. The programme equips learners with analytical thinking, problem-solving ability, laboratory skills, scientific temperament, ethical values, effective communication, teamwork, and digital competency. Students are encouraged to integrate theoretical knowledge with practical experience while developing research aptitude, innovation, environmental awareness, and lifelong learning skills necessary for higher education, competitive examinations, entrepreneurship, and diverse career opportunities.

On successful completion of the programme, graduates will be able to explain core chemical concepts, perform laboratory experiments safely and accurately, analyse and interpret experimental data, use modern scientific instruments appropriately, appreciate interdisciplinary applications of chemistry, and contribute responsibly to society through sustainable and ethical scientific practices.

Course Outcomes (COs)

The Chemistry courses offered to B.Sc. First, Second, and Third Year students enable learners to acquire a comprehensive understanding of physical, organic, inorganic, analytical, and environmental chemistry. Students develop practical laboratory skills, quantitative analysis techniques, instrumental methods, and the ability to solve chemical problems using scientific reasoning. The curriculum strengthens conceptual clarity while fostering critical thinking, observation, and data interpretation.

By the end of the course, students will be able to perform laboratory experiments following safety protocols, analyse chemical reactions and mechanisms, interpret experimental results, apply chemistry to real-life situations, communicate scientific findings effectively, and develop the confidence to pursue higher studies, research, teaching, industry, and other professional careers in chemistry and allied sciences.

Natasha

Rishi
Principal
Rajiv Gandhi Govt. College
Saha (Amala)

Proposed Activity Calendar (August 2026 – March 2027)

Month	Proposed Activity	Objective
August 2026	Orientation Programme & Laboratory Safety Awareness	Introduce laboratory rules and safe chemical handling.
September 2026	Quiz Competition (Chemistry)	Enhance conceptual understanding and scientific aptitude.
October 2026	Poster Making Competition	Promote creativity on environmental and chemical themes.
November 2026	PowerPoint (PPT) Presentation Competition	Develop presentation and communication skills.
January 2027	National Science Day Preparation Activities / Seminar	Promote scientific awareness and research interest.
February 2027	Essay/Extempore/Science Quiz	Strengthen scientific communication and critical thinking.
March 2027	Student Project Presentation & Academic Feedback	Review learning outcomes and encourage research culture.

Chemistry Society (Session 2026–2027)

Designation	Name	Class	Roll No.
President	Shweta	B.Sc. III Year	2024179308
Vice President	Mohit Bhatt	B.Sc. II Year	2025046605
Secretary	Harsh Vardhan	B.Sc. II Year	-

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Lesson Plan

Class: B.Sc. 1st (1st Sem)

Session 2026-27

Name: Dr. Nitin Kumar Verma & Ms. Natasha Kaushal Paper: - Chemistry-I (B23-CHE-101)

Month	Topic
July & August 2026	Gaseous State Kinetic theory of gases, Maxwell's distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity, and most probable velocity. Collision diameter, collision number, collision frequency and mean free path (Derivations excluded) Structure and Bonding Localized and delocalized chemical bond, Van der Waal's interactions, resonance: conditions, resonance effect and its applications, hyperconjugation, inductive effect, Electromeric effect & their comparison. Revision
September 2026	Deviation of Real gases from ideal behaviour, Derivation of Van der Waal's Equation of State, its application in the calculation of Boyle's temperature (compression factor) Critical phenomenon Concept of Critical temperature, critical pressure, critical volume, relationship between critical constants and Van der Waal's constants (Derivation excluded). Mechanism of Organic Reactions Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles. Types of organic reactions. Reactive intermediates - carbocations, carbanions, free radicals, carbenes, (formation, structure & stability).
October 2026	Liquid State Structure of liquids, Properties of liquids – surface tension, refractive index, viscosity, vapour pressure and optical rotation. Solid State Classification of solids, Law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry and symmetry elements, seven crystal systems and fourteen Bravais lattices; Atomic Structure Dual behaviour of matter and radiation, de Broglie's relation, Heisenberg's uncertainty principle, concept of atomic orbitals, significance of quantum numbers, radial and angular wave functions, normal and orthogonal wave functions, significance of Ψ and Ψ^2, shapes of s, p, d, f orbitals, Rules for filling electrons in various orbitals, effective nuclear charge, Slater's rules.
November 2026	X-ray diffraction, Bragg's law, a simple account of Laue method, rotating crystal method and powder pattern method. Periodic table and atomic properties Classification of periodic table, definition of atomic and ionic radii, ionisation energy, electron affinity and electronegativity, trend in periodic table (in s and p-block elements), Pauling, Mulliken, Allred Rachow and Mulliken Jaffe's electronegativity scale, Sanderson's electron density ratio. Test and Assignments

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Lesson Plan

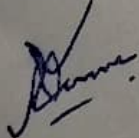
Session 2026-27

Class: B.Sc. 2nd (3rd Sem)

Name: Dr. Nitin Kumar Verma & Ms. Natasha Kaushal Paper: - Chemistry-III (B23-CHE-301)

Month	Topic
July & August 2026	Electrochemistry-I Electrolytic conduction, factors affecting electrolytic conduction, specific conductance, molar conductance, equivalent conductance and relation among them, their variation with concentration. Application of Kohlrausch's Law in calculation of conductance of weak electrolytes at infinite dilution (Numericals) Concepts of pH and pKa, Buffer solution, Buffer action, Henderson – Hazel equation, Buffer mechanism of buffer action. Alkynes Nomenclature and its structure. Methods of formation: using Calcium carbide, dehydrohalogenation, Kolbe's electrolysis. Chemical reactions: Mechanism of electrophilic and nucleophilic addition reactions, formation of metal acetylides, addition of bromine and alkaline KMnO₄, ozonolysis. Acidity of alkynes.
September 2026	Electrochemistry-II Reversible & irreversible cells, Calculation of thermodynamic quantities of cell reaction (ΔG, ΔH & K). Types of reversible electrodes – metal-metal ion, gas electrode, metal – insoluble salt- anion and redox electrodes. Nernst equation, Standard Hydrogen electrode, reference electrodes, Applications of EMF measurement in solubility product and potentiometric titrations using glass electrode. Stereochemistry of Organic Compounds Concept of isomerism: Structural and Stereoisomerism. Symmetry elements, enantiomers, optical activity, properties of enantiomers, chiral and achiral molecules (up-to 2 asymmetric centres), diastereomers, threo- and erythro-nomenclature, meso-compounds, Relative and absolute configuration, sequence rules, R and S system of nomenclature. Cis-Trans isomerism, E & Z system of nomenclature, Conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds. Newman and Sawhorse projection formulae.
October 2026	s and p-Block Elements Salient features of hydrides, oxides, halides, hydroxides of s-block elements (methods of preparation excluded). Structure, preparation and properties of Diborane and Borazine. Benzene and its derivatives: Nomenclature, Aromatic nucleus and side chain, Huckels' rule of aromaticity. Aromatic electrophilic substitution, mechanism of nitration, halogenation, sulphonation, and Friedel - Crafts reaction. Energy profile diagrams. Activating, deactivating substituents and orientation.
November 2026	Catenation, carbides, fluorocarbons, silicates (structural aspects), structure of oxides of Nitrogen and Phosphorous, structure of white and red phosphorus. Structure of oxyacids of Nitrogen, phosphorous, sulphur and chlorine and comparison of acidic strength of oxyacids. low chemical reactivity of noble gases, chemistry of xenon, structure and bonding in fluorides, oxides and oxyfluorides of xenon. Alkyl halides: Nomenclature, methods of formation: from alkenes and alcohol, nucleophilic substitution reactions of alkyl halides, SN₂ and SN₁ reactions with energy profile diagrams. Aryl halides: Methods of formation: halogenation, Sandmeyer reaction. The addition-elimination, and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl, and aryl halides. Test and Assignments

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Class: B.Sc. 3rd (5th Sem)

Session 2026-27

Name: Dr. Nitin Kumar Verma & Ms. Natasha Kaushal Paper: - Chemistry-III (B23-CHF-501)

Month	Topic
July & August 2026	Thermodynamics- II Third law of thermodynamics: Nernst heat theorem, statement of concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, G as criteria for thermodynamic equilibrium and spontaneity, its advantage over entropy change. Variation of G with P, V and T. Partial molar properties, concept of chemical potential (numerical included). Organic Synthesis via Enolates Acidity of α-hydrogens, alkylation of diethyl malonate and ethylacetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.
September 2026	Phase Equilibrium Statement and meaning of the terms - phase, component and degree of freedom, thermodynamic derivation of Gibbs phase rule, phase equilibria of one component system - Example - water system. Phase equilibria of two component systems solid-liquid equilibria, simple eutectic Example Pb-Ag system. Heterocyclic Compounds Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.
October 2026	Quantum Mechanics-I Black-body radiation, Plank's radiation law, photoelectric effect, postulates of quantum mechanics, quantum mechanical operators, commutation relations, Hamiltonian operator, Hermitian operator, average value of square of Hermitian as a positive quantity, Role of operators in quantum mechanics, To show quantum mechanically that position and momentum cannot be predicated simultaneously, Determination of wave function & energy of a particle in one dimensional box. Coordination Compounds Werner's theory of coordination compounds, effective atomic number, chelates, nomenclature of coordination compounds, Isomerism in coordination compounds, valence bond theory of transition metal complexes. Metal- Ligand Bonding in Transition Metal complexes Limitations of valence bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planer complexes
November 2026	Spectroscopy-I Introduction: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Born-oppenheimer approximation, Degrees of freedom. Rotational Spectrum Selection rules, Energy levels of rigid rotator (semi-classical principles), rotational spectra of diatomic molecules, spectral intensity distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length and isotopic effect. Magnetic properties of Transition metal complexes Types of magnetic materials, magnetic susceptibility, method of determining magnetic susceptibility, spin only formula, L-S coupling Test and Assignments

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Chemistry Department Teaching Timetable

Class	9:00-9:45	9:45-10:30	10:30-11:15	11:15-12:00	12:00-12:45	12:45-1:30	1:30-2:15	2:15-3:00
B.Sc I	Chem TH D3 Natasha D4 Natasha (R.N Lab 2)			Chemistry TH D5 Nitin D6 Nitin (R.N Lab 2)		Chem PR D3 Nitin D4 Natasha (R.N Lab 1)	Chem PR D3 Natasha (R.N Lab 1)	
B.Sc II	Chem TH D1 Natasha D2 Natasha (R.N Lab 2)		Chem TH D3 Nitin (R.N Lab 2)		Chem PR D5 Nitin D6 Natasha (R.N Lab 1)	Chem PR D5 Nitin (R.N Lab 1) Chem TH D4 Nitin (R.N Lab 2)		
B.Sc III	Chem TH D5 Natasha D6 Natasha (R.N Lab 2)	Chem TH D4 Nitin (R.N Lab 2)		Chem TH D4 Nitin (R.N Lab 2)	Chem PR D1 Natasha D2 Natasha D3 Nitin (R.N Lab 1)		VOC D1-3 Nitin D4-6 Natasha (R.N Lab 2)	
B.A. II					MDC Chem D1-2,6 Nitin D3-5 Natasha (R.N Lab 2)			
B.Com/BBA I				MDC Chem D1-2-3 Nitin D4-5-6 Natasha (R.N Lab 2)				
B.A. I								EVS D4 Nitin D5 Natasha D6 Nitin (R.N Lab 2)

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