

Programme Outcome, Programme Specific Outcome and Course Outcome
For B.Sc. Honours (1+1+1 Pattern) In Chemistry
2018-2019

Modalities of Marking

Total Marks: 600 (theoretical) + 200 (Practical) = 800

PART I Theoretical Marks Paper I: Inorganic 50 Paper II: Organic 50 Paper III: Physical 50	Practical Paper IV: Organic 50
PART II Theoretical Marks Paper V: Inorganic 50 Paper VI: Organic 50 Paper VII: Physical 50	Practical Paper VIII: Inorganic 50
PART III Theoretical Marks Paper IX: Inorganic 100 Paper X: Organic 100 Paper XI: Physical 100	Practical Paper XII: 100

Department of Chemistry		After successful completion of three year degree program in Chemistry a student should be able to;
PO	Programme Outcomes	Description
PO 1	Sound domain knowledge	Acquiring sound knowledge of chemical concepts and emerging issues in chemical science.
PO2	Academic and Scientific Endeavour	To help the students in developing academic and scientific endeavour by fostering and nurturing the young talent for proper scientific pursuit.
PO3	Creative and Practical Ability to analyse and deal with data	Analysis of experimental data and their representation in the form of graphs and plots. Use of statistics as a means to express complicated chemical data.
PO4	Familiarity with Recent	Should be able to apply modern theories and approaches to explain all spatial phenomena and relate nature with human inter

Developments in relations

	a Particular Field	
PO5	Environmental Awareness	Impact of environmental changes on human and how it can be explained at a global and regional perspective.
PO 6	Laboratory Skill	The students are exposed to modern equipments in the Laboratory where they get hands-on training which help them to succeed at any entry-level position in chemical industry.
PSO	Programme Specific Outcomes	Description
PSO 1	Critical appreciation of the Subject.	Acquiring sound knowledge on the fundamentals of Physico-chemical concepts and applying them in practical and professional situations.
PSO 2	Academic and Scientific Endeavour.	To help the students in developing, Cultivating and demonstrating the art of science learning and teaching by fostering and nurturing the young talent for proper scientific pursuit.
PSO 3	Scientific Attitude	Developing the right scientific temper compatible with creative impulse.
PSO 4	Technical Skill Development	Creating updated knowledge on research methodology and developing skills in the application oriented Chemistry.
PSO 5	Environmental Consciousness	Impact of environmental changes on human and its reflection on society.
PSO 6	Communication Skill	Classroom discussions, student seminar ,written assignments, debates etc. help students to develop effective communication skill which will aid them to enhance employability.
PSO 7	Personality Development	Personality development skills are likely to help students in their professional and personal lives thus making them responsible and sincere citizens of th
PSO 8	Spirit of Team Work	Encouraging students to co-ordinate with one another in a team environment rather than trying to excel individually.
PSO 9	Basic Human Values	Study of various texts and mutual interaction among the students inside and outside the class room help the learners to understand human behavioural science.
<u>Course Outcomes B. ScChemistry (Honours Part-I)</u>		

Paper-I (Inorganic Chemistry)	CO-1. To learn about atomic structure and periodic properties of elements CO-2. To learn chemical bonding and structures of covalent compounds CO-3. To learn about acid base reactions CO-4. To study redox reactions CO-5. To study coordination chemistry
Paper-II (Organic Chemistry)	CO-6. To learn about nomenclature of organic molecules CO-7. To learn about structures and properties of aliphatic, aromatic compounds CO-8. To learn about the introduction to organic reactions CO-9. To know about the reactive intermediates CO-10. To study about stereochemistry CO-11. To study about aliphatic nucleophilic substitution reactions CO-12. To know about elimination reactions
Paper-III Physical Chemistry	CO-13. To learn about kinetic theory of gas CO-14. To learn about detailed thermodynamics and different types of expression CO-15. To study chemical kinetics
Paper-IV Organic Chemistry Practical	CO-16. To study about qualitative analysis of organic samples CO-17. To investigate different types of organic preparation
<u>Course Outcomes B. Sc Chemistry (Honours Part-II)</u>	
Course	Outcomes After completion of these courses students should be able
Paper-V (Inorganic Chemistry)	CO-18. To learn about VBT and CFT, magnetic, colour properties of coordination compounds CO-19. To learn about the chemistry of normal, inert gases, transition metal and lanthanoids and actinoids
Paper-VI (Organic Chemistry)	CO-20. To learn about stereochemistry of organic compounds CO-21. To learn about electrophilic and radical addition CO-22. To learn about nucleophilic addition of carbonyl group CO-23. To know about the molecular rearrangement

	<p>CO-24. To study about reagents in organic synthesis</p> <p>CO-25. To study about named reactions</p> <p>CO-26. To know about alicyclic compounds</p> <p>CO-27. To understand about synthesis of organic compounds</p> <p>CO-28. To investigate about the aromatic electrophilic substitution</p> <p>CO-29. To learn about aromatic nucleophilic substitution reactions</p>
Paper-VII Physical Chemistry	<p>CO-30. To learn about thermodynamics and equilibrium</p> <p>CO-31. To learn about phase equilibrium and colligative properties</p> <p>CO-32. To learn about chemical kinetics</p> <p>CO-4. To study about properties of fluids</p> <p>CO-5. To know about macromolecules</p>
Paper-VIII Inorganic Chemistry Practical	<p>CO-33. To study qualitative analysis of inorganic samples</p> <p>CO-34. To investigate different types of inorganic preparation</p>
<u>Course Outcomes B. Sc Chemistry (Honours Part-III)</u>	
Course	Outcomes After completion of these courses students should be able
Paper-IX (Inorganic Chemistry)	<p>CO-35. To learn about the chemistry of inorganic solids</p> <p>CO-36. To learn about inorganic reaction mechanism</p> <p>CO-37. To learn about the use of metal ions in living system</p> <p>CO-38. To understand organometallic compounds</p> <p>CO-39. To about the synthesis, structure and bonding of carbonyl, nitrosyl and organic compounds</p> <p>CO-40. To learn about nano and supramolecular chemistry</p> <p>CO-41. To clarify about nuclear and radioanalytical chemistry</p> <p>CO-42. To learn about statistical methods in analytical chemistry</p> <p>CO-43. To know about different types of volumetric analysis, titrations, electroanalytical analysis and spectrophotometric analysis</p> <p>CO-44. To know about methodologies in separation chemistry</p>
Paper-X (Organic Chemistry)	<p>CO-45. To learn about chemistry of dyes</p> <p>CO-46. To learn about medicinal chemistry</p> <p>CO-47. To learn about heterocyclic compounds</p> <p>CO-48. To know about the amino acids and proteins</p>

	<p>CO-49. To study about carbohydrates CO-50. To study about alkaloids and terpenoids CO-51. To know about synthetic methodologies CO-52. To understand about pericyclic reactions CO-53. To investigate about the spectral features of organic compounds CO-54. To learn about nucleic acids CO-55. To learn about green chemistry</p>
Paper-XI Physical Chemistry	<p>CO-56. To learn about conductive properties of electrolytic solutions CO-57. To learn about electrochemical cell CO-58. To learn about properties of solids and crystallography CO-59. To study about surface chemistry and adsorption CO-60. To know about colloids CO-61. To learn about electrical properties of molecules CO-62. Learn about symmetry elements and group theory CO-63. To learn about application of quantum theory to chemical systems CO-64. To learn theoretical background of photochemical features and spectral features of elements and compounds CO-65. To learn about statistical thermodynamics</p>
Paper-XII Inorganic, Analytical and Physical Chemistry Practical	<p>CO-66. To study quantitative analysis of inorganic mixtures by redox and complexometric methods CO-67. To investigate titrimetric and colorimetric analysis CO-68. To learn about various physical and chemical properties, to study kinetics of chemical reactions and conductometric and potentiometric titration</p>

Programme Outcome, Programme Specific Outcome and Course Outcome
For B. Sc. General (1+1+1 Pattern) in Chemistry
2018-2019

Total Marks: 265 (theoretical) + 135 (Practical) = 400

PART I Theoretical Marks Paper I: Group A: General principles 50 Group B: Organic 50	Practical -20
PART II Paper II: Group A: Inorganic 50 Group B: Physical 50	Practical Marks Paper III: Qualitative (Inorganic + Organic) 65 Laboratory Note Book 05 Viva-Voce 10
PART III Theoretical Marks Paper IV: Chemistry (General) 65	Practical Paper V: Inorganic Quantitative 35

COURSE OUTCOME FOR CHEMISTRY GENERAL

Paper I

Module -General Principles

Group A

COURSE	OUTCOME
<p>Unit-1 :Atomic Structure Bohr's theory: energy H-like atoms, dual nature of matter and light, de Broglie's relationsh principle (qualitative), quantum numbers, Pauli exclusion principle, qualitative introduction of orbitals, shapes of orbitals, electron distribution of elements - Aufbau principl</p>	<p style="text-align: center;">Outcome :</p> <p>1.1 Students have been exposed to the important features of the quantum mechanical model of atom. 1.2 Bohr's theory, de Broglie's theory, uncertainty Principle, Pauli Exclusion Principle, Aufbau Principle all stated and explained.</p>
<p>Unit -2 :Radioactivity Theory of disintegration, rate constant, half life period (their interrelationship –deduction) idea of disintegration series, artificial transmutation and artificial radioactivity, uses and abuses of radioactivity. Stability of atomic nucleus, n/p ratio, mass defect, binding energy.</p>	<p style="text-align: center;">Outcome :</p> <p>2.1 Students are able to understand the nature of the nucleus and the nuclear properties that are of most importance in chemistry and mankind. 2.2 Students are also familiarized with how the use of both radioactive and stable isotopes has aided in the determination of the mechanisms of simple chemical reactions and complex biological processes.</p>
<p>Unit-3 :Periodic Table and Periodic Properties Periodic law, Periodic classification of elements on the basis of electron distribution, s-, p- and d-block elements, connection among valencies, electron distribution and positions of the elements in the long form of the periodic table. Periodic properties: atomic radii, ionic radii, covalent radii, ionisation energy, electron affinity, electronegativity and its different scales.</p>	<p style="text-align: center;">Outcome :</p> <p>3.1 Students will be able to learn how with the help of Periodic law it is possible to organise and to systematise the chemistry of the elements into a manageable subject. 3.2 Students will be able to appreciate how the concept of grouping elements in accordance to their properties led to the development of the Periodic Table. 3.3 Classify elements into s, p, d blocks and learn their main characteristics.</p>
<p>Unit-4 :Chemical Forces and Molecular Structure Ionic bond, covalent bond (octet rule and expanded octet), dative bond, deformation of ions and Fajan's-Haber cycle, hydrogen bond: intra- and intermolecular, bond polarity and dipole moment. Bond lengths, bond angles and qualitative description of shapes of some simple molecules like CO₂, SO₂, H₂O, BeCl₂, BF₃, NH₃, CH₄, C₂H₄, C₂H₂, C₆H₆.</p>	<p style="text-align: center;">Outcome :</p> <p>4.1 Students will be able to explain the formation of different types of bonds. 4.2 Students will understand the important parameters associated with chemical bonds like bond length, bond angle, bond enthalpy, bond order, and bond polarity. 4.3 Students will appreciate the different types of hybridization and draw the shapes of simple covalent molecules.</p>
<p>Unit- 5 : Oxidation and Reduction Electronic concepts, oxidation number, ion-electron method of balancing equations,</p>	<p style="text-align: center;">Outcome :</p> <p>5.1 Mechanism of redox reactions by electron transfer process is explained.</p>

<p>application of redox reactions, idea of standard potential and formal potential. Derivation of thermodynamic quantities ΔH and ΔS).</p>	<p>5.2 Students will learn how to balance chemical equations using ion-electron method. 5.3 Student will be able to understand the concept of redox reactions in terms of electrode processes.</p>
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<p>Unit-6 :Acids and Bases, Buffers and Ionic Equilibrium Different concept of acids and bases, ionic product of water, salt hydrolysis, pH and its colorimetric determination, Strengths of strong and weak acids and bases, Ostwald dilution law, Henderson equation, neutralization and acid-base indicators, buffers, common ion effect, solubility product (application in analytical chemistry)</p>	<p>Outcome : 6.1 This unit offers the students a chance to learn general principles which are important in industrial, analytical, and physiological chemistry. 6.2 Students are exposed to different modern theories of acids and bases and different equilibrium processes involved in solutions of acids, bases and salts. 6.3 The pH scale, Henderson equation, Mechanism of Buffer action, Solubility Product all explained in details.</p>
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Group B

Module - Organic Chemistry

<p>Unit- 7:Functional Nature of Organic Compounds Classification of organic compounds in terms of functional groups, their IUPAC nomenclature and valence bond structures.</p>	<p>Outcome : 7.1 Students will be able to understand the classification of organic compounds on the basis of functional groups. 7.2 They will appreciate the reasons for the tetra valence of carbon and shapes of organic molecules and their valence bond structures. 7.3 Students will be able to name the compounds according to IUPAC system.</p>
<p>Unit-8:Electron Displacement in Molecules Concept of Inductive effect, Electromeric effect, Hyperconjugation, Resonance, Aromaticity and Tautomerism.</p>	<p>Outcome : 8.1 Students are exposed to understand the influence of electronic displacements on structure and reactivity of organic compounds.</p>
<p>Unit-9:Introduction to Organic Reaction Mechanism Homolytic and heterolytic bond cleavage; Reaction intermediates: carbocation, carbanion, free radical. Classification of organic reactions (substitution, elimination, addition and rearrangement) and reagent types (electrophiles, nucleophiles, acids and bases), Ideas of organic reaction mechanism (SN1, SN2, E1 and E2).</p>	<p>Outcome : 9.1 Student will learn and understand the basic concept of organic reaction mechanism. 9.2 They will also be able to identify the different types of organic reactions and mechanisms and classify their categories.</p>

<p>Unit-10: Chemistry of Hydrocarbons</p> <p>a) Free radical substitutions of alkanes; b) Formation of alkenes, electrophilic addition reactions of alkenes (upto four carbon atoms), peroxide effect, ozonolysis, radical addition and catalytic reductions; c) Formation of alkynes, their partial and complete reductions and hydration. Halogen derivatives of alkanes, their nucleophilic substitutions and elimination reactions.</p>	<p>Outcome :</p> <p>10.1 Student will learn various methods of formation of alkanes, alkenes and their important physical and chemical properties. 10.2 They will be able to predict the formation of the addition and substitution products of alkanes, alkenes, and alkynes on the basis of their electronic mechanism.</p>
<p>Unit-11 : Mono and Bifunctional Compounds</p> <p>Preparations and properties of primary, secondary and tertiary monohydric alcohols, ethers, ethylene glycol, pinacol and glycerol; aldehydes and ketones; monocarboxylic acids and their derivatives: acid chlorides, anhydrides, esters, amides; amines; unsaturated alcohol (allyl alcohol), unsaturated aldehyde (acrolein), unsaturated carboxylic acid (acrylic acid), unsaturated ester (methyl acrylate), di- and tribasic acids (oxalic, malonic, succinic acids; malic and citric acids).</p>	<p>Outcome :</p> <p>11.1 This unit describes the preparation, physical properties and main chemical reactions of alcohols, ethers, glycerol, aldehydes and ketones, amides, amines, acids and esters.</p>
<p>Unit-12: Stereochemistry</p> <p>Concept of optical activity, optical properties of lactic acid and tartaric acid, <i>D,L</i> and <i>R,S</i> nomenclature; Geometrical isomerism with reference to fumaric acid and maleic acid; <i>cis-trans</i> and <i>E, Z</i> nomenclature.</p>	<p>Outcome :</p> <p>12.1 This unit deals with the study of molecules in three dimensions. 12.2 Students learn how atoms in a molecule are arranged in space relative to one another. 12.3 Three main aspects of stereochemistry are covered in this unit i.e. geometric isomers, conformation of molecules and chirality of molecules along with <i>cis-trans</i> and <i>E, Z</i> nomenclature.</p>
<p>Unit-13: Chemistry of Aromatic Compounds</p> <p>Modern concept of structure of benzene, general mechanism of aromatic electrophilic substitution reactions, preparations and properties of toluene, xylene, halobenzenes, benzyl chloride, benzoyl chloride, benzotrichloride, nitrobenzene, dinitrobenzene, TNT, aniline, methyl and dimethyl aniline, benzyl amine benzene diazonium chloride, phenols, benzyl alcohol, benzaldehyde, acetophenone, benzoic acid, anhydride, amides, esters; phenyl acetic acid, salicylic acid, cinnamic acid, sulphanilic acid, phenyl hydrazine, nitrophenols and picric acid.</p>	<p>Outcome :</p> <p>13.1 This unit formalizes the definition of aromaticity and discusses the properties and reactions of benzene and substituted benzenes. 13.2 Students will be familiarised with the modern concept of structure of benzene and general mechanism of aromatic electrophilic substitution reactions. 13.3 They will be able to draw orbital picture of aromatic compounds and explain the origin of directive effect.</p>
<p>Unit-14: Organic Synthesis</p> <p>Preparation and synthetic uses of diethyl malonate and ethylacetoacetate. Application of</p>	<p>Outcome :</p> <p>14.1 Students will get acquainted with the preparation and synthetic uses of diethyl malonate and ethyl</p>

Grignard reagents in synthesis of ketones, secondary and tertiary alcohols and carboxylic acids.	acetoacctata. 14.2 Application of Grignard reagents in the synthesis of ketones, alcohols, and carboxylic acids.
Unit-15: Carbohydrates Open-chain and ring structures glucose, fructose and their mutarotation, idea of dissacharides with reference to cane sugar.	Outcome : 15.1 Students are able to differentiate between open-chain and ring structure of glucose, fructose and their important properties.

PART II
Paper II
Group A

Module - Inorganic Chemistry

Unit-16: Coordination Chemistry Double and complex ligands, coordination number, inner metallic complexes, chelate effect, different types of isomerism, IUPAC nomenclature.	Outcome : 16.1 Students will be able to appreciate the nature of bonding in co-ordination compounds. 16.2 They will learn about primary and secondary valences, IUPAC nomenclature of complexes, different types of structural and stereo-isomers, Chelate effect.
Unit-17: Group Chemistry Group 1: Hydrogen – isotopes and binary hydrides, lithium and its similarities and differences from other alkali metals, diagonal relationship with magnesium, lithium aluminium hydrides. Group 2: Calcium, strontium and barium, hydrolith, calcium cyanamide, gypsum and plaster of paris. Group 12: Zinc, cadmium and mercury Millon's base. Group 13: Diborane, boron trifluoride, sodium borohydride, inorganic benzene. Group 14: Carbon, silicon, tin and lead, carbide, silicon carbide, silica, sodium silicate. Silica gel, hydrofluorosilicic acid, silicon tetra chloride, glass, fullerene. Group 15: Nitrogen, phosphorus, arsenic, antimony and bismuth, hydrazine, hydrazoic acid, hydroxyl amine, hyponitrous acid, phosphorus oxyacids (H ₃ PO ₂ , H ₃ PO ₃ , H ₃ PO ₄ , H ₄ P ₂ O ₇ and HPO ₃), sodium bismuthate. Group 16: Oxygen and sulphur, composition and structure of ozone, oxyacids of sulphur (H ₂ SO ₃ , H ₂ SO ₄ , H ₂ S ₂ O ₃ , H ₂ S ₂ O ₈), persulphate Group 17: Fluorine, chlorine, bromine and iodine, oxides and oxyacids of chlorine, isolation of fluorine. Group 18: Rare gases (isolation and uses) with special reference to general fluorides (structure)	Outcome : 17.1 This unit describes and explain the general characteristics of the alkali and alkaline earth metals. 17.2 Students will be able to present informed opinions on the position of Hydrogen in the periodic table. 17.3 Students will appreciate the general trends in the chemistry of p-block elements. 17.4 Students will be able to understand the trends in physical and chemical properties of group 12 to group 18 elements.

<p>Unit-18 :Transition Metals</p> <p>Groups 6 and 7: Chromium, manganese, K_2CrO_4, $K_2Cr_2O_7$, CrO_2Cl_2, $KMnO_4$, chrome alum.</p> <p>Groups 8, 9 and 10: Iron, cobalt and nickel, principles of isolation of Ni (excluding details), composition and uses of alloys, steels, rusting of iron, galvanization and tin plating</p> <p>Group 11: Cu, Ag, Au, principles of Ag and Au isolation, different valency states</p>	<p>Outcome :</p> <p>18.1 Students will appreciate the general trends in the chemistry of group 6 to group 11 elements.</p> <p>18.2 They will know the principles of isolation and different valency states of coinage metals.</p>

Group B

Module - Physical Chemistry

<p>Unit-19 : Kinetic Theory of Gases</p> <p>Ideal gas equation, derivation of gas laws, Maxwell's speed and (derivation excluded); distribution curves; different types of speeds and their significance, concept of equipartition principle, van der Waals equation, Virial equation, continuity of state, Boyle temperature, critical constants, specific heats and specific ratios, laws of partial pressure, vapour density and density method of determination of molecular weights, limiting density, abnormal vapour density, frequency of binary collisions; mean free path</p>	<p>Outcome :</p> <p>19.1 To understand the basic assumption of Kinetic theory.</p> <p>19.2 To develop the concept of pressure and temperature on the basis of kinetic theory of gases.</p> <p>19.3 Collision phenomenon and mean free path are treated in brief. Distribution of velocities is discussed in detail.</p> <p>19.4 Maxwell's speed distribution dimension are derived.</p> <p>19.5 Different types of velocities, equipartition principle and heat capacity of gases discussed.</p>
<p>Unit-20 :Thermodynamics</p> <p>Thermal equilibrium and zeroth law, First law, reversible and irreversible work, criteria of perfect gas, isothermal and adiabatic expansions, Joule-Thomson effect (derivation excluded); Thermochemistry: Hess its application Second law and its elementary interpretation, Car Clausius inequality, criteria of spontaneity, free energy and entropy</p>	<p>Outcome :</p> <p>20.1 To introduce students to some basic concepts of thermodynamics including heat, energy, work.</p> <p>20.2 Reversible and Irreversible processes, perpetual motion 1st law.</p> <p>20.3 Enable students to learn about thermodynamics equations and the related laws.</p> <p>20.4 The second law provides proper information about spontaneous processes and the direction of a particular spontaneous transformation can also be obtained with its help.</p> <p>20.5 The concept of entropy is developed through Carnot cycle and other auxiliary state functions have been introduced.</p> <p>20.6 The concept of inversion temperature is introduced through Joule- Thomson experiment.</p>
<p>Unit-21: Equilibrium</p> <p>Conditions of spontaneity and equilibrium,</p>	<p>Outcome :</p>

<p>degree of advancement and Le Chatelier principle; Van't Hoff 21.1 In this unit free isochore</p>	<p>energy considerations have been applied to reacting systems.</p> <p>21.2 Simple chemical reactions, their equilibrium positions and applications of Le Chatelier principle are discussed.</p> <p>21.3 Thermodynamic applications have also been considered.</p>
<p>Unit-22 : Phase Equilibria and Colligative Properties</p> <p>Phase rule equation (derivation excluded); phase diagram of water system, Miscibility (phenol-water) and distillation of completely miscible binary liquid mixtures; azeotropes, Steam distillation Graphical approach of Raoult's law of liquid-vapour properties: osmosis, lowering of freezing point, elevation of boiling point, experimental methods of determination of molecular weights of substances in dilute solutions and abnormal behaviour of electrolytic solutions</p>	<p>Outcome :</p> <p>22.1 Statement and derivation of phase rule done to interpret and explain various physical changes that occur frequently in one component systems.</p> <p>22.2 The solution process is explained thermodynamically. Different concentration terms are interrelated.</p> <p>22.3 Ideal solution and ideally dilute solutions are defined.</p> <p>22.4 Colligative properties are defined, explained and studied. Deviations are also explained.</p>
<p>Unit-23: Properties of Matter</p> <p>Viscosity of fluids, temperature and pressure dependence, Surface energy and surface tension of liquids: temperature dependence Unit cell, Bravais lattice; crystal system, Miller indices; Bragg's equation</p>	<p>Outcome :</p> <p>23.1 This unit deals with the internal and external structure and properties of crystals.</p> <p>23.2 Miller notations for specifying crystal faces and planes have been explained.</p> <p>23.3 X-ray diffraction and Powder diffraction method treated for structural analysis sodium chloride. Crystal planes, interplanar distance and indexing of planes are explained. Different types of crystal systems are discussed. Bragg method of X-ray structural analysis of crystals discussed.</p>
<p>Unit-24: Electrochemistry</p> <p>Electrolytic conduction, transport number (experimental determination excluded), velocity of ions: specific, equivalent and molar conductances, determination of equivalent conductivity of solution strong and weak electrolytes, Ion atmosphere; electrophoretic and relaxation effects, Debye-Huckel theory (qualitative) and the limiting law. Electrochemical cells, half-cells (with</p>	<p>Outcome :</p> <p>24.1 This section deals with solutions of electrolytes and the phenomena occurring at the electrodes.</p> <p>24.2 The students will study the effects of the passage of a current through electrolytes. The properties of electrolyte solutions are discussed.</p> <p>24.3 Methods of experimental determination of Specific conductance are discussed. Some applications of conductance measurements are explained.</p>

<p>types and examples), Nernst equation and standard electrode potentials, standard cells</p>	<p>24.4 Experimental methods of determination of transport number are outlined. The effects of frequency and voltage on conductance of solution are explained.</p>
<p>Unit-25: Chemical Kinetics Order and molecularity of reactions, integrated rate laws (first and second order), average life period, concept of Arrhenius activation energy Catalysis, autocatalysis, enzyme catalyst, catalyst poisons, promoters, elementary treatment of mechanism of catalysis</p>	<p style="text-align: center;">Outcome :</p> <p>25.1 This unit deals with the rates of chemical reactions. The rate equation, order and molecularity are defined. Kinetic experiments are outlined. Methods are suggested for determining the order of reactions. Different types of simultaneous reactions have been discussed.</p> <p>25.2 The role of temperature and theories of reaction rates have been discussed. The mechanism and methods of proposing it are outlined. Uni and bi molecular reactions are analysed.</p> <p>25.3 Activation energy concept is enumerated. Finally some aspects of collision and transition state theory are discussed.</p>
<p>Unit-26: Photochemistry and Spectroscopy Absorption, Lambert-Beer's photochemical laws, primary photophysical processes, potential energy diagram, Franck-Condon principle, fluorescence and phosphorescence, Jablonsky diagram, Laws of photochemistry, quantum yield, kinetics of HI decomposition, H₂-Br₂ reactions Elementary idea of rotational and vibrational spectra</p>	<p style="text-align: center;">Outcome :</p> <p>26.1 The study of photochemistry embraces all of the phenomenon associated with absorption and emission of radiation .</p> <p>26.2 It deals with that are mainly spectroscopic, such as fluorescence and phosphorescence.</p> <p>26.3 Student will be in a position to understand and interpret absorption of radiation and Lambert-Bee law. They should be able to explain the kinetics of photochemical reactions.</p> <p>26.4 Elementary idea of rotational and vibrational spectra introduced.</p>

Module - Practical

Paper III

Unit - 27 :Inorganic Qualitative Detection of three radicals by analysis of mixture containing not more than three radicals from the following list (insoluble salts excluded) Silver, lead, mercury, bismuth, copper, cadmium, arsenic, antimony, tin, iron, aluminium, chromium, zinc, manganese, cobalt, nickel, calcium, strontium, barium, magnesium, sodium, potassium, ammonium and their oxides, hydroxides, chlorides, bromides, iodides, sulphates, sulphites, sulphides, thiosulphates, chromates, phosphates, nitrites, nitrates and borates.	Outcome : 27.1 The goal of this unit is to provide the students with enough chemical tests for individual metal ions, non-metal ions and radicals. 27.2 Students will be able to carry out qualitative analysis of unknown inorganic sample containing not more than three radicals.
Unit –28 : Organic Qualitative Detection of elements (N, S, Cl) and any one of the following groups in organic compounds (solid only): -NH ₂ , -NO ₂ , -CONH ₂ , -OH, >C=O, -CHO, -COOH	Outcome : 28.1 The goal of this unit is to provide the students with enough chemical tests for the detection of elements and functional groups present in a solid organic compound.

PART III

Paper IV

Module - Chemistry (General)

Unit-29: Analytical Chemistry (a) Accuracy and precision in analysis, types of errors, data analysis and curve fitting (linear $Y = mX + C$ type), numerical problems, mean, mode and variance (b) Principles of acid-base titration, use of indicators and indicator constant, titration of Na ₂ CO ₃ + NaHCO ₃ mixture vs HCl using different indicators, estimation of mixture of strong and weak acids, qualitative discussion of salt hydrolysis (no derivation) (c) Single electrode potential and emf of a chemical cell, principles of redox titration, use of redox potentials, iodometry, iodimetry, use of K ₂ Cr ₂ O ₇ and KMnO ₄ as oxidant (acid, neutral and alkaline media)	Outcome : 29.1 To instil among the students the basic knowledge of Accuracy and Precision in quantitative analysis. 29.2 To give a thorough understanding of mean, mode, variance and standard deviation and their use in data analysis and curve fitting. 29.3 Student will be familiar with the principles of acid-base titration, redox titration, iodometry and iodimetry.
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Unit-30 :Green Chemistry

Outcome :

<p>Basic principles of green chemistry. Tools of green chemistry including the use of alternative feed stocks or starting materials, reagents, solvents, target molecules, and catalysts (homogeneous, heterogeneous and biocatalysis), green chemistry as the alternative chemistry for protection of environment.</p>	<p>30.1 Students will appreciate the importance of green chemistry in day to day life. 30.2 Understand the basic principles and tools of green chemistry. 30.3 Develop green chemistry as the alternative chemistry for the protection of environment.</p>
<p>Unit-31 : Chemistry of Selected Biomolecules Structural aspects (excluding elucidation and stereochemistry, unless specified) and important function of d/l-sucrose and polysaccharides (starch and cellulose), amino acids (classification, essential amino acids like glycine, alanine, methionine and tryptophan with d/l), proteins (special reference to the peptide bond, action of haemoglobin, idea of denaturation of proteins, classification and functions of enzymes in general), pyrrole, pyridine, pyrimidine and purine, nucleic acids (DNA and RNA), nucleotide and nucleoside.</p>	<p style="text-align: center;">Outcome :</p> <p>31.1 In this unit the students will learn that Biomolecules like proteins, carbohydrates, amino acids, nucleic acids are present in extraordinary variety and most of them are extremely complex. 31.2 They will be able to understand the properties and functions of enzymes, nature of peptide bond, denaturation of proteins, structure and functions of Nucleic acids, action of haemoglobin.</p>
<p>Unit-32 : Medicinal Chemistry Antipyretics and analgesics like paracetamol and aspirin, sulphadiazine, antibiotics like penicillin and chloramphenicol, ofloxacin; antiamoebic like metronidazole, anticancer drugs, drugs used for AIDS (detailed structures are not needed, only the nature and function of the drugs)</p>	<p style="text-align: center;">Outcome :</p> <p>32.1 Students will appreciate how chemistry plays an important role in improving the quality of human life. 32.2 They will be able to understand how medicines are used to prevent or reduce sufferings caused by diseases. 32.3 Nature and function of antibiotics, anticancer drugs, drugs used for AIDS.</p>
<p>Unit-33 : Nano Chemistry Elementary idea on nano materials. Basic chemical strategy for making nanomaterials. Nanoclusters, Nanowires and Carbon Nanotubes. Applications.</p>	<p style="text-align: center;">Outcome :</p> <p>33.1 Students are exposed to the elementary ideas on nano-materials. 33.2 Basic chemical strategy for making nano-materials. 33.3 Students will be familiarised with Nanoclusters, Nanotubes, Nanowires.</p>
<p>unit-34: Colloidal State General classification, general methods of preparation of lyophobic colloids and general properties of colloids, ideas of coagulation, peptization, protective colloids, dialysis, gold number, isoelectric point, Brownian motion</p>	<p style="text-align: center;">Outcome:</p> <p>34.1 Students get acquainted with the general methods of preparation of different types of colloids. 34.2 They will get ideas on coagulation, peptization, protective colloids, origin of charge on colloids.</p>
<p>unit-35 : Macromolecular Chemistry Introduction, definition of macromolecules, natural and synthetic polymers, monomers, polymers, degree of polymerization, simple idea of polymer structure: homopolymer (linear, branched, cross-linked) and copolymer (random, block, graft), polymerization reaction step (growth, addition, ring opening), importance of</p>	<p style="text-align: center;">Outcome :</p> <p>35.1 Students will be able to explain the terms monomer, polymer, degree of polymerisation, and appreciate their importance. 35.2 They will understand the distinction between various classes of polymers and different types of polymerisation processes. 35.3 Student will appreciate the formation of polymers</p>

<p>polymers both natural and synthetic Number and weight average molecular weights of polymers – significance, structure and use of natural rubber, synthetic rubber (neoprene), synthetic fibres (Nylon 66, poly ester), plastics like polyethylene and PVC, macromolecules and environment</p>	<p>from mono and bi-functional monomer molecules. 35.4 They will also appreciate the importance of polymers in daily life.</p>
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Module –Practical

Paper V

<p>Unit 36 :Inorganic Quantitative</p> <p>a. Titration of $\text{Na}_2\text{CO}_3 + \text{NaHCO}_3$ mixture vs HCl using phenolphthalein and methyl orange indicators</p> <p>b. To find the total hardness of water by EDTA titration</p> <p>c. To find the pH of an unknown solution by comparing colour of a series of (HCl solutions + 1 drop of methyl orange) and a similar series of (NaOH solutions + 1 drop of phenolphthalein)</p> <p>d. Estimation of saponification equivalent of a supplied ester/oil</p> <p>e. Titration of ferrous iron by $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$</p> <p>f. Titration of ferric iron by $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ using SnCl_2 reduction</p>	<p>Outcome :</p> <p>36.1 The students will be exposed to inorganic quantitative analysis by performing (a) Acid-base titration (b) Redox titration (c) Complexometric titration.</p>
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BANKURA ZILLA SARADAMANI MAHILA MAHAVIDYAPITH
Department of Chemistry

Program Outcome (PO): B.Sc.(General) Chemistry

PO	Program Outcome	Description
PO 1	Sound domain knowledge	Acquiring sound knowledge of chemical concepts and emerging issues in chemical science.
PO2	Academic and Scientific Endeavour	To help the students in developing academic and scientific endeavour by fostering and nurturing the young talent for proper scientific pursuit.
PO3	Creative and Practical Ability to analyse and deal with data	Analysis of experimental data and their representation in the form of graphs and plots. Use of statistics as a means to express complicated chemical data.
PO4	Familiarity with Recent Developments in a Particular Field	Should be able to apply modern theories and approaches to explain all spatial phenomena and relate nature with human inter relations
PO5	Environmental Awareness	Impact of environmental changes on human and how it can be explained at a global and regional perspective.
PO 6	Laboratory Skill	The students are exposed to modern equipments in the Laboratory where they get hands-on training which help them to succeed at any entry-level position in chemical industry.

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 Department of Chemistry
Program Specific Outcome (PSO): B.Sc.(General) Chemistry

PSO	Program Specific Outcome	Description
PSO 1	Critical appreciation of the Subject.	Acquiring sound knowledge on the fundamentals of Physico-chemical concepts and applying them in practical and professional situations.
PSO 2	Academic and Scientific Endeavour.	To help the students in developing, Cultivating and demonstrating the art of science learning and teaching by fostering and nurturing the young talent for proper scientific pursuit.
PSO 3	Scientific Attitude	Developing the right scientific temper compatible with creative impulse.
PSO 4	Technical Skill Development	Creating updated knowledge on research methodology and developing skills in the application oriented Chemistry.
PSO 5	Environmental Consciousness	Impact of environmental changes on human and its reflection on society.
PSO 6	Communication Skill	Classroom discussions, student seminar ,written assignments, debates etc. help students to develop effective communication skill which will aid them to enhance employability.
PSO 7	Personality Development	Personality development skills are likely to help students in their professional and personal lives thus making them responsible and sincere citizens of the society.
PSO 8	Spirit of Team Work	Encouraging students to co-ordinate with one another in a team environment rather than trying to excel individually.
PSO 9	Basic Human Values	Study of various texts and mutual interaction among the students inside and outside the class room help the learners to understand human behavioural science.