

Name of department: Chemistry

Part I: Course outcome

Name of Programme **Course/Paper** **Name of course/Paper** **Course outcome (should include one point for each unit of the paper)**

B.A./B.Sc./B.Com./B.Sc. H.Sc. I

Paper I

Inorganic Chemistry

Students are enabled to get a fundamental knowledge of inorganic chemistry including atomic structure and the Periodic properties of elements.

Enable students to learn the Chemical bonding, shape of molecules and theories like VBT and MOT and the formation of molecules.

Enable students to know the properties of s & p block elements and their comparative studies.

Enable to understand the chemistry of Noble gases as well as the theory and principle of qualitative analysis. enables them to learn scientific reasoning and solving analytical problems.

Paper II

Organic Chemistry

Enable the students to learn basic concepts and terminology used in the organic chemistry.

Stereochemistry enables them to know the structure of organic compounds and their behaviour.

Conformation analysis enables them to learn the stability of the compounds.

Chemistry of aliphatic hydrocarbon with sigma and pi bonds, chemistry of alkenes and alkynes.

Chemistry of aromatic hydrocarbon enables them to differentiate between aliphatic and aromatic compounds.

Paper III

Physical Chemistry



Enables students to have a basic approach on the mathematical concept required for the chemist.

Gaseous state and liquid state chemistry give idea about gas behaviour and various laws regarding this and also properties of liquids.

Colloids and surface chemistry, solid state chemistry, kinetics and catalysis gives the physical and mathematical aspects of chemistry.

In solid state chemistry students are enable to learn the symmetry, space group, crystal systems, and the properties of crystals.

Chemical kinetics enables the student to know the physical properties of a chemical reactions. It includes the rate law, rate of reactions, order of reactions, as well as the catalytic effect on the chemical reactions.



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<u>B.A./B.Sc./B.Com./B.Sc. H.Sc. II</u>	Paper I	Inorganic Chemistry	<p>Enable student to understand chemistry of transition series elements.</p> <p>Enable to know the oxidation and reduction phenomenon and its applications. Also enable to know the introductory of co-ordination compounds.</p> <p>Enable to know the chemistry of the co-ordination compounds.</p> <p>Enable to understand the chemistry of Lanthanides and Actinides.</p> <p>Enable to understand concepts of acids and bases, reactions in non-aqueous solvents with special reference to liquid ammonia and Sulphur dioxide.</p>
	Paper II	Organic Chemistry	<p>Enable students to learn the chemistry of organic halides.</p> <p>Enable to understand the preparation, chemical properties of alcohols and phenols.</p> <p>Enable to understand the preparation, chemical properties of aldehydes and ketones.</p> <p>Enable to understand the preparation, chemical properties of carboxylic acids and their derivatives.</p> <p>Enable to understand the preparation, chemical properties of organic compound of nitrogen.</p>
	Paper III	Physical Chemistry	<p>Enable students to understand use of units and notation in thermodynamics. Also enable to understand concepts of entropy, enthalpy, reversibility and irreversibility.</p> <p>Enable to understand first second and law of thermodynamics and other thermodynamic properties.</p> <p>Enable to know the process, concepts and theories of chemical equilibrium and ionic equilibria.</p> <p>Enable to understand the phase equilibrium and different phase systems.</p> <p>Enable to understand the physical phenomenon of photochemistry.</p>



B.A./B.Sc./B.Com./B.Sc. H.Sc. III	Paper I	Inorganic Chemistry	<p>Enable student to know the meaning of various term involved in co-ordination chemistry. To understand the limitations of valence bond theory. Also enable to understand the crystal field theory and crystal field splitting in octahedral, tetrahedral and square planner complexes.</p> <p>Enable to understand the reason of magnetic properties, magnetic susceptibility, L-S coupling, magnetic moment of transition metal complexes.</p> <p>Enable to know the classification organo-metallic compounds, preparation, properties bonding and application of alkyl and aryl organo-metallic compounds.</p> <p>Enable to understand the significance of essential and trace elements in biological processes, the biological role of alkali and alkaline earth metals.</p> <p>Enable to classify acids and bases as hard and soft acid and Enable to understand Pearson's HSAB concepts. Also enable to learn the silicons, phosphazenes (inorganic polymers), nature of bonding in triphosphazenes.</p>
	Paper II	Organic Chemistry	<p>Enable students to know about organometallic compounds, organo-sulphur compounds and organic synthesis via enolates.</p> <p>Enable to know about biomolecules in detail viz carbohydrates, proteins and nucleic acids.</p> <p>Enable to know the characteristics of different synthetic polymer and synthetic dyes.</p> <p>Enable to learn the fundamental spectroscopy and their applications in chemistry viz mass spectrometry, infrared spectroscopy and UV-Visible spectroscopy.</p> <p>Enable to know the Nuclear magnetic resonance spectroscopy, ¹³CMR spectroscopy and Magnetic Resonance Imaging (MRI).</p>
	Paper III	Physical Chemistry	<p>Enable to know the fundamentals of the quantum mechanics viz black body radiation, Plank's law, different quantum mechanical effects, principles, Schrodinger wave equation and their application in the chemistry.</p> <p>Enable the students to detail approach in quantum mechanics of different orbital systems and calculation of energy for wave functions.</p> <p>Enable the students to know the physical aspects of the spectroscopy viz rotational spectroscopy, vibrational spectroscopy and Raman spectroscopy.</p> <p>Enable to learn the electronic spectroscopy and the spectroscopic phenomenon in the photochemistry.</p> <p>Enable the students to know the thermodynamic law and physical properties of molecular structure and different magnetic properties.</p>



M.A./M.Sc./M.Com./M.Sc. H.Sc. I se Paper I

Enable students to learn the symmetry and symmetry elements their operation and the symmetry point group. This also enables students to form the character table of different point groups and their characteristics and spectroscopic properties. Enable to understand crystal field theory, Molecular orbital theory, types of complexes (octahedral, tetrahedral and square planar complexes), and type of bonding and Molecular orbital theory. Enable to understand metal carbonyl and their structure and bonding, enable to, to understand the reactions of metal metal nitrosyl, di-nitrogen and di-oxygen complexes, tertiary phosphine as ligand.

Enable to understand metal ligand equilibria, stepwise and overall formation constants, trends in stepwise constants, factors affecting the stability of metal complexes. Enable to understand the topic Isopoly and heteropoly acid. Also enable to learn the classification, preparation, properties and structures of Borides, Carbides, Nitrides and Silicides and Silicates.

Enable to understand metal clusters including higher boranes, carboranes, metalloboranes and metallocarboranes, metal carbonyl and halide cluster.

Paper II

Enable to learn the nature of bonding in organic molecules, electronic effects and aromaticity
Enable to understand conformational analysis cycloalkanes, decalins, effect of conformation on reactivity, conformation of sugars, steric strain. To learn the stereochemistry which includes Elements of symmetry, chirality, , methods of resolution, optical purity, stereospecific and stereoselective synthesis. etc.

Enable to understand the generation and reactions of intermediates viz carbocations, carbanions, free radicals, carbenes and nitrenes. Sandmeyer reaction and Free radical.

Enable to understand the pericyclic reactions and their mechanism

Paper III

Enable to learn the mathematical concept in quantum chemistry which includes vector, dot cross and triple products, complex numbers and co-ordinate transformations differential and integral calculus, quantum mechanics, the schrodinger equation and its applications.

Enable to learn the basics of thermodynamics: maxwell's thermodynamic relations and its applications.

Enable to learn elementary electrochemistry which includes electrochemistry of solution, debye-huckel onsager treatment and its extension, ion solvent interactions, Debye-Huckel-limiting law, Debye-Huckel theory for activity coefficient of electrolytic solutions.

Enable to learn chemical dynamics viz methods of determining rate laws, consecutive reactions, collision theory of reaction rates, steric factor, activated complex theory, kinetic salt effects, steady state kinetics and thermodynamic and Kinetic control of reactions etc.

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Paper IV

Enable students to know the basic terms of the spectroscopy and their uses in the spectroscopic phenomenon.

Microwave spectroscopy enables students to learn the type of the molecules and their interaction with microwave radiation. Also enable to learn the spectral properties and application of the microwave spectroscopy.

In this unit student learn about the different types of scattering spectroscopy, their principle, instrumentation and uses in the field of chemistry.

Raman spectroscopy is the very important part of the spectroscopy enable student to know about the Raman Effect, theories of Raman Effect, instrumentation and its application in molecular structure.

M.A./M.Sc./M.Com./M.Sc. H.Sc. II s Paper I

Enable to understand the reaction mechanism of transition metal complexes includes energy profile of a reaction, reactivity of metal complexes inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution, anation reactions etc.

Enable to learn the electronic spectra and magnetic properties of transition metal complexes.

Enable to learn the preparations, properties, nature of bonding and structure and reactions of transition metal complexes with unsaturated organic molecules such as alkanes, allyl, diene dienyl, arene.

Enable to understand the transition metals compound with bond to hydrogen: transition metals compounds with bond to hydrogen. unit iv a. alkyls and aryls of transition metals: Types, routes of synthesis, stability and decomposition pathways, organocopper in organic synthesis.

Enable to learn the compounds of transition metal – carbon multiple bonds and structural characteristics, fluxional organometallic compounds.

Paper II

Enable to understand the aliphatic nucleophilic and aromatic nucleophilic substitution reaction and its mechanism.

Enable to understand aliphatic electrophilic and aromatic electrophilic substitution reaction and its mechanisms.

Enable to learn the addition reaction to carbon-carbon multiple bonds, mechanistic and stereochemical aspects of addition reactions.

Enable to understand the addition to carbon-hetero multiple bonds, Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds.

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Paper III

Enable to understand the application of matrices Angular Momentum in quantum chemistry and the approximation methods.

Enable to understand the thermodynamics of non ideal gases and non equilibrium thermodynamics. Enable to learn electrochemistry II includes the structure of electrified interfaces. Gouy-Chapman, Stern, over potentials and exchange current density, Derivation of Butler – Volmer equation, Tafel plot. Semiconductor interfaces, Theory of double layer at semiconductor, electrolyte solution interfaces, structure of double layer interfaces.

Enable to understand chemical dynamics- II: General features of fast reactions by flow method, relaxation method dynamics of unimolecular reaction. [Lindemann – Hinshelwood and Rice-Ramsperger-Kassel-Marcus {RRKM}] theories.

Paper IV

Enable student to learn about the various type of electronic transitions, Beer – Lambert Law, Fieser-Woodward rule for the calculation of λ_{max} of different conjugated dienes and carbonyl compounds. This also enable students to interpretate the UV-Visible spectra for the identification of molecules.

Infrared spectroscopy is a vibrational spectroscopy which enables students to learn the vibrational behavior of the molecules and their interaction with EMR. This also enable students to interpretate the IR spectra for the identification of structure of the compounds.

Enable students to learn the fragmentation pattern of molecules, factor affecting the fragmentation, rearrangement reaction, instrumentation and characteristics of mass spectra of different organic molecules.

NMR and Carbon 13 NMR enable students to know the nuclear spin and its resonance after interaction with EMR. This also enable to learn the interpretation of MNR data for the structure elucidation of organic molecules.

M.A./M.Sc./M.Com./M.Sc. H.Sc. III : Paper I

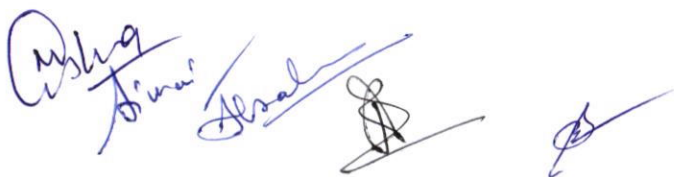
Enable to understand Principle and Application of “Electron Spin Resonance and nuclear Spin Quadrupole Resonance spectroscopy”.

Enable to understand basic principles of “Photoelectric effect “and spectra for atoms and molecules.

Enable to understand basic principles of “Photoacoustic Spectroscopy”

Enable to understand process of “Photochemical reactions”.

Enable to understand Enable to understand Photochemistry of Alkenes, carbonyl compounds and Aromatic compounds.



Paper II

Enable students' bioenergetics, electron transfer reaction in biology and transport & storage of dioxygen.

Enable to know the mechanism of metalloenzymes and enzyme models.

Enable to learn the enzymes and Co-enzyme chemistry and biotechnological application of enzymes.

Enable students to know the biopolymer interaction, thermodynamics of biopolymer solution, cell membrane and transport of ions.

Paper III

Enable students to learn the statistical thermodynamics viz Maxwell Boltzmann distribution, Fermi-Dirac and Bose-Einstein statistics etc.

Enable students to know the polymer chemistry i.e. polymerization and chemistry of polymerization.

Enable students to learn the chemistry of solid matter such as crystals and their properties. Also enable students to learn the electronic and band theory.

Enable the students to learn the process of micellization and the adsorption phenomenon.

Paper IV

Enable students to learn about the sampling, collection, preservation, sample preparation and sample pretreatment process before analysis. This also enables analytical data acquisition and statistical analysis of the data.

Enable students to learn the separation through extraction, instrumental separation technique viz chromatography TLC and HPLC.

Enable students to know the thermal and automated methods.

Enable students to learn the principle, instrumentation and application of the major electro analytical techniques viz pH potentiometry, conductometry, plarography, and voltametry.

Enable to understand structure and synthesis of steroids and plant pigments .

Enable to understand steps of drug design and its activity

Enable to understand pharmacokinetics and pharmacodynamics.

Enable to understand constitution and synthesis of antibiotics.

Enable to understand synthesis and properties of antimalarials.

M.A./M.Sc./M.Com./M.Sc. H.Sc. IV : Paper I

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Paper II	<p>Enable to understand function and applications of acid, bases, electrophiles, nucleophiles and catalyst</p> <p>Enable to understand chemistry of materials.</p> <p>Enable to understand various nuclear models</p> <p>Enable to understand process of nuclear energy and process of nuclear fission</p> <p>Enable to understand types of fuels and its analysis.</p> <p>Enable to understand application of nuclear chemistry in various fields.</p> <p>Enable to understand techniques of detection of nuclear radiations.</p>
Paper III	<p>Enable to understand techniques and application of advanced chromatography.</p> <p>Enable to understand principles, instrumentation and application of x-ray and proton induced spectroscopy</p> <p>Enable to understand instrumentation and application of "atomic emission spectroscopy"</p> <p>Enable to understand instrumentation and application of "atomic absorption spectroscopy"</p>
Paper IV	<p>Enable to understand classification, monitoring and analysis of air pollution</p> <p>Enable to understand quality standards, monitoring and analysis of soil and water pollution</p> <p>Enable to understand food adulterants and techniques of food analysis.</p> <p>Enable to understand action of drugs and analysis of drugs.</p> <p>Enable to understand types of fuels and analysis of fuels.</p>

Part II: Programme outcome
Name of programme/degree

Name of subject Programme outcome

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B.A./B.Sc./B.Com./B.Sc. H.Sc. Chemistry

1. After successful completion of three-year degree program with chemistry as one of the core subject a students will be able to:
2. Demonstrate, solve and have an understanding of major concepts in all disciplines of chemistry.
3. Gain the knowledge of chemistry through theory and practical.
4. To explore nomenclature, stereochemistry, structures, reactivity and mechanism of the chemical reactions.
5. Identify chemical formulae and solve numerical problems.
6. Know the structure activity relationship, understand good laboratory practice and safety.
7. Students can expand the knowledge available opportunities related to the chemistry in government and private sectors specially in the field of food safety, quality control, health inspector, pharmacist, environmentalist, chemists and also, they can choose to civil services.

M.A./M.Sc./M.Com./M.Sc. H.Sc. Chemistry

After completion of degree, students gained the theoretical as well as practical knowledge of handling chemicals. Also, they expand the knowledge available opportunities related to chemistry in the government services through public service commission particularly in the field of food safety, health inspector, pharmacist etc. Afford a broad foundation in chemistry that stresses scientific reasoning and analytical problem solving with a molecular perspective. Achieve the skills required to succeed in graduate school, professional school and the chemical industry like cement industries, agro product, Paint industries, Rubber industries, Petrochemical industries, Food processing industries, Fertilizer industries etc. Got exposures of a breadth of experimental techniques using modern instrumentation. Understand the importance of the elements in the periodic table including their physical and chemical nature and role in the daily life. Understand the concept of chemistry to inter relate and interact to the other subject like mathematics, physics, biological science etc. Learn the laboratory skills and safely to transfer and interpret knowledge entirely in the working environment.

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