

B.Sc (Hons) I Year

Chemistry

Inorganic chemistry

Atomic structure: Wave mechanical model, Schrödinger wave equation, quantum numbers, multi electron atoms, screening effect, Slater's rules, electronegativity. Chemical bonding: Ionic bonding, covalent bonding, VSEPR theory, Molecular orbital theory, ionic character in covalent compounds and metallic bonding

Weak chemical forces

Acids and bases.

Organic chemistry

Nomenclature, classification, hybridization, resonance, inductive effect, hyperconjugation, chromatographic purification, alkanes, alkenes, alkynes, alcohols, alkyl halides, petroleum products and aromatic hydrocarbons.

Physical chemistry

Kinetic theory of gases: molecular model of a gas, derivation of kinetic molecular equation, gas laws, ideal gas behavior, deviations from ideality, van der Waal's equation, critical phenomenon, critical temperature, volume and pressure. Properties of gas molecules, viscosity, mean value theorem, barometric distribution law, Maxwell-Boltzmann distribution of velocities and energy, degrees of freedom, law of equipartition of energy, intermolecular forces. Liquid state: (vapour pressure, viscosity, surface tension).

Introduction to thermodynamics, Zeroth and first laws of thermodynamics, Hess's law, Second law of thermodynamics, Gibbs free energy, internal energy and Helmholtz free energy

Intermolecular forces: electrical origin of non ideal behavior

Environmental Chemistry

Non renewable and renewable sources of energy. Nuclear pollution, disposal of nuclear wastes, nuclear disasters (Chernobyl and Three Mile Island disasters) and their management. Noise, soil and water pollution: hydrological cycle, water resources, aquatic ecosystems, impact of pollutants on water cycle and ecosystems, waste water treatment, Water purification methods. Environment and its segments, ecosystems, biogeochemical cycle of (carbon, nitrogen, sulphur, oxygen, phosphorus), major regions of atmosphere, details of major air pollutants, ozone depletion, biochemical effects of arsenic, cadmium, lead, mercury, CO, oxides of nitrogen and sulphur, PAN, cyanide, photochemical smog, effects of pesticides, Insecticides (DDT, MIC), Bhopal gas tragedy, detection of fluoride, chlorine, chloride, sulphate, nitrate, phosphate, alkalinity, acidity and microorganisms. Drinking water parameters, sources and nature of water pollutants, preventive measures, techniques and procedures of measuring pollutants.

Physics

Mechanics (kinematics, laws of motion, moment of inertia, angular momentum, torque, work, power and energy, frictional force, collisions), Wave optics (Fresnel and Fraunhofer diffraction, polarisation), Vectors (dot and cross product, gradient, vector field, scalar field, divergence, vector integration and differentiation, Stokes and Divergence theorem), Waves and oscillations.

Mathematics

Leibnitz theorem and nth derivative of some functions, Rolle's and Lagrange's theorem and their geometrical interpretation, Taylor's and Maclaurin's series, tangents and normals, partial

differentiation, curvature, asymptotes, curve tracing, rational functions and their integration, properties of definite integrals, simple reduction formulae, area and length of curve in planes, centre of gravity, moment of inertia, entire differential equations, straight lines, circles, parabola, ellipse, hyperbola, tracing of conics (simple examples), 3D (planes, lines and sphere), complex numbers and De-Moivre's theorem and theory of equations (relations b/w roots and coefficients of cubic equations and symmetric functions of roots)

Inorganic chemistry practicals

Organic chemistry practicals

Physical chemistry practicals

Physics practicals

BSc(Hons) II year

Chemistry

Inorganic Chemistry

General Principles of metallurgy: Modes of occurrence of metals, concentration of the ores, calcination, roasting and smelting. Role of carbon and other reducing agents, electrolytic reduction, hydrometallurgy, Ellingham diagrams and methods of refining and purification of the ores

Chemistry of s,p block elements:

General periodic trends, variable oxidation states, diagonal relationship and anomalous behavior of first element of the group. Detailed study of the following compounds: Boric acid, borates, boron nitride, borohydrides, carboranes, graphitic compounds, silanes, oxides and oxyacids of nitrogen, phosphorus and chlorine, peroxy acids of sulphur, thionic acids and interhalogen compounds, polyhalide ions, pseudohalogens and basic properties of halogens. Occurrence and use of noble gases, clathrates, bonding in noble gas compounds and shapes of noble gases.

All principles involved in the II year practical course.

Organic chemistry

Aliphatic and aromatic ethers. Structure, nomenclature, preparations and reactions of aldehydes, ketones (aliphatic and aromatic), thiols, thioethers and sulphonic acids, carboxylic acids and their functional derivatives (aliphatic and aromatic), acid chlorides, anhydrides, amides and esters. Role of carbonyl group in different reactions. Preparation, structure and synthesis of nitrocompounds and active methylene compounds, amines, dibasic acids, hydroxy acids, unsaturated alcohols, maleic and fumaric acids and unsaturated carbonyl compounds, urea and urethane

Stereochemistry: Optical activity, optical isomerism, configurational nomenclature, absolute configurations and geometrical isomerism.

Physical chemistry

Chemical thermodynamics: Systems of variable composition

Gibbs Duhem equation, chemical potential of ideal gases, chemical equilibria in ideal gases, Le Chatelier principle, equilibria in polyelectrolytic systems, hydrolysis and hydrolysis constants.

Phase equilibria: Concept of phases, components degrees of freedom, derivation of phase rule

Solutions: Dilute solutions, binary solutions: Duhem Margules equation, azeotropes, lever rule, partial miscibility of liquids, CST, miscible pairs, steam distillation, Nerst distribution law.

Phase diagram for systems of solid liquid equilibria.

Macromolecules: Study of different type of macromolecules and methods of determining molecular mass of polymers like osmotic pressure, sedimentation etc.

Conductance: metallic and electrolytic conduction, experimental methods of determining conductance, conductance of strong and weak electrolytes, transport numbers, anomalous transport numbers, Walden's rule. Applications of conductance: conductometric titrations.

Computer and its applications to chemistry(option A) :problem solving and basic programming
Entrepreneurship and small business(option B); small business, financing of small business,
issues in small business marketing and growth of small business

Mathematics

Algebra of matrices, Carley hamiltonian theorm,sequences,double and tripple integrals,statistics

Physics

Electrostatics,magnetism,fundamental laws of electromagnetism,electronics,digital,electronics

Inorganic chemistry practicals

Organic chemistry practicals

Physical chemistry practicals

Physics practicals

Computer practicals(optional)

BSc. (Hons) III year

Chemistry

Inorganic chemistry

Transition elements: general group trends, colour, magnetic and catalytic properties of the transition elements, Latimer and Ebsworth diagrams. Chemistry of Ti,V,Cr,Mn,Fe and Co.

Lanthanides and Actinides: electronic configuration, colour, spectral and magnetic properties, lanthanide contraction and separation of lanthanides.

Coodination Chemistry: Bonding theories Warner's theory, Valence bond, Crystal field theory, (Jahn Teller distortion), Ligand Field theory. Nomenclature, isomerism and stereochemistry of complexes, chelate effect, trans effect, thermodynamic and kinetic stability of complexes.

Organometallics: Definition, classification of organometallic compounds, metal alkyls, effective atomic number rule, metal carbonyls, ferrocene, and olefin complexes.

Bioinorganic chemistry : Metal ions present in the biological system, biochemistry of sodium, potassium ,magnesium ,calcium, iron and zinc. Excess and deficiency of metal ions. Toxicity of metal ions.

Inorganic polymers

Non aqueous solvents

Principles involved in qualitative analysis of a mixture of cations and anions and gravimetric.

Organic chemistry

Cabohydrates : Occurrence, classification and properties of monosaccharides, configurations of hydroxyl groups ,mutarotation, Haworth projection, elementary treatment of starch ,cellulose and glycogen.

Aminoacids ,peptides and proteins: Synthesis and properties of proteins, zwitterionic nature, isoelectric point, electrophoresis, classification and biological importance of proteins, secondary structure of proteins ,pyrimidines and purines .Synthesis, reaction and elementary idea of nucleic acids

Enzymes: nomenclature, coenzymes, specificity, stereospecificity of enzymes, alcoholic fermentation, Kreb's cycle and glycolysis.

Lipids: Biological functions, oils and fats, industrial oils of vegetable origin, extraction, refining, hydrogenation, identification of fats and oils, saponification value, acid value, iodine number, reversion and rancidity of oils.

Terpenes: Essential oils, occurrence, isolation, classification, chemical composition, isoprene rule, structure and synthesis of citral and dipentene, classical and non classical carbonium ions.

Cleansing agents: Mineral and fixed oils, toilet and washing soap and synthetic detergents.

Spectroscopy: UV,IR,NMR and their applications to identification of organic compounds
Polynuclear hydrocarbons: naphthalene, anthracene and phenanthrene
Heterocyclic compounds: Synthesis, reaction, and aromaticity of furan, pyrrole, indole, thiophene, quinoline and isoquinoline
Pharmaceutical compounds: sulphadruugs - sulphadiazine, analgesics (asprine, phenacetin, paracetamol) antimalarials- chloroquine and antibiotics - chloramphenicol
Dyes: synthesis and importance of azo dyes methyl red, methyl orange,congo red, Triphenylmethane dyes: malachite green, pararosaniline, rosaniline, crystal violet, methyl violet, Phthalein dyes: phenolphthalein ,fluorescene, copper phthalocyanine, alizarin, indigo.
Polymers: synthetic polymers,type of polymers, polymerization reactions, mechanism of polymerization, Zeigler Natta catalyst, vinyl polymers, natural and synthetic rubbers.
Alkaloids: Occurance, importance and properties of alkaloids (nicotine, atropine, cocaine), and Hofmann's exhaustive methylation.

Physical chemistry

Chemical kinetics: order of a reaction, rate law, differential and integral rate expressions, kinetics'of complex reactions, opposing, parallel, consecutive reactions and their differential equations, chain reactions, catalysis, Michaelis menten equation, acid base catalysis, activation energy, collision theory of reaction rates,and Lindemann mechanism

Photochemistry

Laws of light absorbtion and photochemistry, Primary and secondary effects of light absorbtion, quantum efficiency and its experimental determination with emphasis on actinometry. Reasons of reactions with low and high quantum efficiency.

Electrochemical cells

Electromotive force of a cell and its measurement, Nerst equation, application of EMF measurement in determining the free energy, enthalpy, entropy, equilibrium constants and pH value. Concentration cells, liquid junction potential and potentiometric titrations.

Surface chemistry

physical adsorbtion, chemisorption, adsorption isotherms, catalytic activity,mechanism of catalyzed reactions and micelles.

Atomic structure

Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation, energy levels and wave functions ,qualitative treatment of rigid rotator, harmonic oscillator, hydrogen atom, electronspin and multielectron systems. Covalent bonding: Variation theorem, valence bond, molecular orbital approach, treatment of $H_2, H_2^+, BeH_2, H_2O, CO_2$

Electric and magnetic properties of matter.

Molecular structure

Molecular spectroscopy: Interaction of electromagnetic radiation with molecular systems. Born-Openheimer equation, Evaluation of physical parameters of diatomic and triatomic species, Vibrational ,Raman ,Electronic, Electron spin resonance and Nuclear magnetic resonance spectroscopy.

Structure of condensed phases.: Nature of solid state, symmetry elements, symmetry operations, crystal systems and X-ray diffraction.

Inorganic chemistry practicals

Organic chemistry practicals

Physical chemistry practicals