

B.Sc. Part - II (Physics)

Paper I – Electricity, Magnetism

Electrostatics

Coulomb's law, Electric Field and potentials, Field due to a uniform charged sphere, Derivations of Poisson and Laplace Equations, Gauss Law and its application: The Field of a conductor. Electric dipole, Field and potential due to an electric dipole, Dipole approximation for an arbitrary charged distribution, Electric quadrupole, Field due to a quadrupole, Electrostatic Energy of a charged uniform sphere, Energy of a condenser.

Unit -II

Magnetostatics

Magnetic field, Magnetic force on a current, Magnetic Induction and Biot – Savart Law, Lorentz Force, Vector and Scalar Magnetic potentials, Magnetic Dipole, Magnetomotive force and Ampere's Circuital theorem and its applications to calculate magnetic field due to wire carrying current and solenoid.

Unit -III

Electromagnetic Induction

Laws of Induction, Faraday's laws and Lenz's Law. Mutual and Self Induction, Vector potential in varying Magnetic field, Induction of current in continuous media, Skin effect. Motion of Electron in changing magnetic field, Betatron, Magnetic energy in field, Induced magnetic field (Time varying electric field), Displacement current, Maxwell's equations, Electromagnetic waves in free space, Poynting Vector, Theory and working of moving coil ballistic galvanometer.

Unit -IV

Dielectrics

Dielectric constant, polarization, Electronic polarization, Atomic or ionic Polarisation, Polarisation charges, Electrostatic equation with dielectrics, Field, force and energy in Dielectrics.

Magnetisation Properties of Matter

Intensity of magnetization and magnetic susceptibility, Properties of Dia, Para and Ferromagnetic materials, Curie temperature, Hysteresis and its experimental determination.

Paper II – Thermal Physics

Unit – I

Thermal equilibrium, Zeroth law of thermodynamics, Temperature concept, Equations of State, Van der Waal's equation, Critical constants, principle of corresponding states.

Unit –II

First law of thermodynamics , Absolute scale of temperature Entropy , Degradation of energy , Enthalpy Helmholtz function , Gibbs function , Maxwell's thermodynamics relations and their application.

Unit –III

Differential and Integral Joule Thomson effect, Inversion temperature, Liquification of gasses (no Experimental details). Adiabatic demagnetization, He I and II. Clausius Clapeyron equation.

Unit – IV

Kinetic theory, Maxwell – Boltzmann law, Equipartition of energy, Mean free path, transport phenomena, Brownian motion Avogadro number.

Thermodynamic and Kinetic temperature, Blackbody radiation, Stefan Boltzmann's law , Plsnck's law and its verification .

Paper III – Elements of Quantum Mechanics and Atomic Spectra.

Unit –I

Inadequacies of classical mechanics , Photoelectric phenomena , Compton effect , Wave-particle duality , de Briglie matter waves and their experimental verification , Heisenberg's Uncertainty principle , Complementary principle , Principle of superposition , Motion of wave packets .

Unit –II

Schr'odinger wave equation , Interpretation of wave function , Expectation values of dynamical variables , Ehrenfest theorem , Orthonormal properties of wave functions , One diomensional motion in step potential , Rectangular barrier , Square well potential , Particle in a box normalization .

Unit –III

Bohr atomic model, Sommerfeld elliptic orbits, Spin and orbital magnetic moments, Stern – Gerlach experiment, Pauli's exclusion principle and periodic table. Optical spectra of alkali and alkaline earth elements, Fine structure of spectral lines, Coupling schemes (LS and JJ) for two electron systems.

Unit -IV

Normal and anomalous Zeeman Effect and Paschen Back effect of one electron systems, Experimental observation, X-ray spectra – continuous and characteristic, their generation and uses, Spin and screening doublets.

Books Recommended:

1. A Beiser- Concept of Modern Physics, McGraw-Hill, New York.
2. R.M. Eisberg – fundamentals of Modern Physics, Wiley, New York.
3. H.E. White – Introduction to Atomic Spectra, McGraw-Hill, New York.



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Physical Chemistry

Semester II

Paper 3

Max Marks: 100 (80 + 20)

UNIT I

- I. Mathematical Concepts: Logarithmic relations, curves sketching, equation of straight line and slopes, tracing of curves, differentiation of simple functions like x , e^x , x^n , $\sin x$, $\log x$; maxima and minima, partial differentiation. Integration of some useful/relevant functions; Permutations and Combinations. Factorials, Probability.
- II. Computers: General introduction to computers, different components of a computer. Hardware and Software, input-output devices, binary numbers and its arithmetic; introduction to computer languages, Programming and operating systems.

UNIT II

- III. Gaseous State: Deviation of gases from ideal behaviour, van der Waals equation of State.
- IV. Critical phenomenon: PV isotherms of real gases, continuity of states, the isotherms of van der Waals equations, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of states.
- V. Molecular Velocities: Qualitative discussion of the Maxwell's distribution of molecular velocities, collision numbers, mean free path and collision diameter. Liquification of gases (based on Joule Thomson effect).
- VI. Liquid State: A qualitative description of intermolecular forces, structure of liquids, structural differences between solids, liquids and gases.
- VII. Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic, smectic and cholesteric liquid crystals. Thermography and seven segment cell.

UNIT III

- VIII. Solid State: Definition of unit cell and space lattice.
- IX. Laws of crystallography:
 - a. Law of constancy of interfacial angles
 - b. Law of rationality of indices
 - c. Symmetry elements in crystals and law of symmetry.
- X. Diffraction-X-ray diffraction by crystals. Derivation of Bragg's equation. Laue's method and powder method, determination of crystal structure of NaCl, KCl and CsCl
- XI. Colloidal State: Solids in liquids (sols): properties- Kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulz law, gold number.
- XII. Liquids in liquids (emulsions): types of emulsions, preparation. Emulsifier.



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Paper 3

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XIII. Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.

UNIT IV

XIV. Chemical Kinetics:

- a. Molecularity and order of reaction, concentration dependence of rates, integrated rate expression for- zero order, first order, second order, pseudo order reactions, half-life.
- b. Determination of the order of reaction: Differential method, method of integration, half-life method and isolation method.
- c. Brief outlines of experimental methods of studying chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometry.
- d. Theories of chemical kinetics: Arrhenius theory of reaction rate, effect of temperature on rate of reaction, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Thermodynamics aspect of transition state theory.

XV. Catalysis: Catalysis, classification of catalysis, characteristics of catalysed reactions,

Text Books (Theory Courses):

- a. Physical Chemistry, Puri Sharma & Pathania.
- b. Pradeep Physical Chemistry, Khetrpal, Pradeep Publication.
- c. Computers and Common Sense, R. Hunt and Shelly, Prentice Hall.

Reference Books:

- a. Physical Chemistry. G.M. Barrow. International Student Edition, McGrawHill
- b. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd.
- c. The Elements of Physical Chemistry, P.W. Atkins, Oxford.
- d. Physical Chemistry Through problems, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.
- e. Basic Programming with Application, V.K. Jain, Tata McGraw Hill.
- f. Physical Chemistry, Glasstone



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Semester II **Chemistry** **Practical** **Max Marks: 100**

Inorganic

I. Qualitative Analyses:

- a. Identification of cations and anions in a mixture of inorganic compounds soluble in water/dilute acids (Macro/semi-micro analysis- cation analysis, separation of ions from group 0-VI, anion analysis). Only six radicals.

II. Quantitative Analysis:

a. Volumetric Analysis

- i. Determination of acetic acid in commercial vinegar using NaOH
- ii. Determination of alkali content - antacid tablet using HCl.
- iii. Estimation of calcium content in chalk as calcium oxalate by permanganometry
- iv. Estimation of hardness of water by EDTA
- v. Estimation of ferrous ions by dichromate method
- vi. Estimation of copper using thiosulphate.

b. Gravimetric Analysis

- i. Ba as $BaSO_4$ in the given solution of $BaCl_2$
- ii. Analysis of Cu as CuSCN
- iii. Analysis of Ni as $Ni(DMG)_2$

Record & Viva

B.A./B.Sc. I (Semester II)
Mathematics
(Applicable from January 2019)

Paper I (Matrices & Differential Equations)

Unit I

Types of Matrices, Elementary operations on Matrices, Rank of a Matrix, Echelon form of a Matrix, Normal form of a Matrix, Inverse of a Matrix by elementary operations, System of linear homogeneous and non-homogeneous equations, Theorems on consistency of a system of linear equations.

Unit II

Eigen values, Eigen vectors and characteristic equation of a matrix, Caley-Hamilton theorem and its use in finding inverse of a matrix, Complex functions and separation into real and imaginary parts, Exponential and Logarithmic functions Inverse trigonometric and hyperbolic functions,

Unit III

Formation of differential equations, Geometrical meaning of a differential equation, Equation of first order and first degree, Equation in which the variables are separable, Homogeneous equations, Exact differential equations and equations reducible to the exact form, Linear equations.

Unit IV

First order higher degree equations solvable for x , y , p , Clairaut's equation and singular solutions, orthogonal trajectories, Linear differential equation of order greater than one with constant coefficients, Cauchy- Euler form.

PaperII (Geometry)

Unit I

General equation of second degree, System of conics, Tracing of conics, Confocal conics, Polar equation of conics and its properties.

Unit II

Three-Dimensional Coordinates, Projection and Direction Cosine, Plane (Cartesian and vector form), Straight line in three dimension (Cartesian and vector form).

Unit III

Sphere, Cone and Cylinder.

Unit IV

Central conicoids, Paraboloids, Plane section of conicoids, Generating lines, Confocal conicoids, Reduction of second degree equations.