

B.Sc. Part-II
(SYLLABUS- CHEMISTRY, PHYSICS & MATH)

RAJKAMAL SCIENCE & MANAGEMENT COLLEGE
BAHADRABAD (HARIDWAR)

CHEMISTRY SYLLABUS

For

UNDER GRADUATE COURSES (B.Sc. Part-II)
(Annual System)

(Applicable w.e.f. the Session 2019-2020)



Department of Chemistry
Sridev Suman Uttarakhand University Badshahithaul Tehri-
Garhwal - 249001

B.Sc. (II YEAR) CHEMISTRY

There shall be three written papers and a practical examination as follows:

Paper	Paper Code	Course	Max. Marks	Work Hrs
I	CH-201	Inorganic Chemistry	50	60
II	CH-202	Organic Chemistry	50	60
III	CH-203	Physical Chemistry	50	60
	CH-204	Laboratory Practical	50	60
		Grand Total	200	180

Candidate will be required to pass in Theory and Practical Separately.

B.Sc. – II Inorganic Chemistry Paper-I

Unit – I

- I.** Chemistry of Elements of First Transition Series:
Characteristic properties of d-block elements. Binary compounds (hydrides, carbides and oxides) of the elements of the first transition series and complexes with respect to relative stability of their oxidation states, coordination number and geometry.
- II.** Chemistry of Elements of Second and Third Transition Series:
General characteristics, comparative treatment of Zr/Hf, Nb/Ta, Mo/W in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry.

Unit – II

- III.** Coordination Compounds
Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

Unit – III

- IV.** Chemistry of Lanthanide Elements
Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, ceric ammonium sulphate and its analytical uses.

V. Chemistry of Actinides

Electronic configuration, oxidation states and magnetic properties, chemistry of separation of Np, Pu and Am from U.

Unit – IV**VI. Oxidation and Reduction**

Electrode potential, electrochemical series and its applications, Principles involved in the extraction of the elements.

Unit - V**VII. Acids and Bases**

Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concept of acids and bases.

VIII. Non-aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics, Reactions in non-aqueous solvents with reference to liquid NH_3 and Liquid SO_2 .

Chemistry Paper-II (Organic Chemistry)**Unit – I****I. Electromagnetic Spectrum Absorption Spectra**

Ultraviolet (UV) absorption spectroscopy – absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome, Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. U.V. spectra of conjugated enes and enones.

Infrared (I.R.) absorption spectroscopy – molecular vibrations, Hooke's law, selection rules, intensity and position of I.R. bands, measurement of I.R. spectrum, finger print region, characteristic absorptions of various functional groups and interpretation of I.R. spectra of simple organic compounds.

Unit – II**II. Alcohols**

Classification and nomenclature, Monohydric alcohols – nomenclature, methods of formation by reduction of Aldehydes, Ketones, Carboxylic acids and Esters,

Hydrogen bonding, Acidic nature, Reactions of alcohols.

Dihydric alcohols - – nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$\text{Pb}(\text{OAc})_4$ and HIO_4] and pinacol- pinacolone rearrangement.

Trihydric alcohols - nomenclature, methods of formation, chemical reactions of glycerol.

III. Phenols:

Nomenclature, structure and bonding, preparation of phenols, physical properties and acidic character, Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols – electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

Unit – III

IV. Ethers and Epoxides

Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions – cleavage and autoxidation, Ziesel's method.

Synthesis of epoxides, Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organo lithium reagents with epoxides.

V. Aldehydes and Ketones:

Nomenclature and structure of the carbonyl groups, synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones uses 1, 3-dithianes, synthesis of ketones from nitrites and from carboxylic acids, Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction.

Use of acetals as protecting group, Oxidation of aldehydes, Baeyer-Villiger oxidation of Ketones, Cannizzaro reaction, MPV, Clemmensen, Wolff-Kishner, LiAlH_4 and NaBH_4 reductions. Halogenation of enolizable ketones, An introduction to O, P unsaturated aldehydes and Ketones.

Unit – IV

VI. Carboxylic Acids:

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength, Preparation of carboxylic acids, Reactions of carboxylic acids, Hell-Volhard-Zelinsky reaction, Synthesis of acid chlorides, esters and amides, Reduction of carboxylic acids, Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids, Hydroxy acids: malic, tartaric and citric acids. Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents.

VII. Carboxylic Acid Derivatives

Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives, Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reaction. Mechanisms of esterification and hydrolysis (acidic and basic)

Unit - V**VIII. Organic Compounds of Nitrogen:**

Preparation of nitroalkanes and nitroarenes, Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media, Picric acid.

Halonitroarenes: reactivity, Structure and nomenclature of amines, physical properties, Stereochemistry of amines, Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts, Preparation of alkyl and aryl amines (reduction of nitro compounds, nitrites), reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction, Hofmann-bromamide reaction. Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, azo coupling.

Physical Chemistry Paper-III**Unit – I****I. Thermodynamics – I**

Definitions of thermodynamic terms: System, surroundings etc. types of systems, intensive and extensive properties, State and path functions and their differentials, Thermodynamic processes, concept of heat and work.

First Law of Thermodynamics: Statement, definition of internal energy and enthalpy, Heat capacity, heat capacities at constant volume and pressure and their relationship, Joule's law – Joule-Thomson coefficient and inversion temperature. Calculation of w , q , ΔU & ΔH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermochemistry: Standard state, standard enthalpy of formation – Hess's Law of heat summation and its applications, Heat of reaction at constant pressure and at constant volume, Enthalpy of neutralization, Bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy, Kirchhoff's equation

Unit – II

II. Thermodynamics – II

Second Law of Thermodynamics: Need for the law, different statements of the law, Carnot's cycle and its efficiency, Carnot's theorem. Thermodynamic scale of temperature.

Concept of entropy: Entropy as a state function, entropy as a function of V & T , entropy as a function of P & T , entropy change in physical change, Clausius inequality, entropy as criteria of spontaneity and equilibrium, Equilibrium change in ideal gases and mixing of gases.

Gibbs and Helmholtz functions: Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with P , V and T .

Third Law of Thermodynamics: Nernst heat theorem, statement and concept of residual entropy. Nernst distribution law – thermodynamic derivation, applications.

Unit - III

III. Chemical Equilibrium

Equilibrium constant and free energy, Thermodynamic derivation of law of mass action, Le Chatelier's principle. Reaction isotherm and reaction isochore – Clapeyron-Clausius equation and its applications.

Unit – IV**IV. Electrochemistry – I:**

Electrical transport: Conduction in metals and in electrolyte solutions, specific conductance molar and equivalent conductance, measurement of equivalent conductance, variation of molar equivalent and specific conductance with dilution.

Migration of ions and Kohlrausch's law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations, Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only),

Transport number, definition and determination by Hittorf's method and moving boundary method.

Applications of conductivity measurements: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

V. Solutions:

Liquid – Liquid mixtures- Ideal liquid mixtures, Raoult's and Henry's law, Non-ideal system- azeotropes – HCl-H₂O and ethanol – water systems.

Partially miscible liquids- Phenol – water, trimethylamine – water, nicotine-water systems, Immiscible liquids, steam distillation.

Unit – V**VI. Electrochemistry – II:**

Types of reversible electrodes – gas-metal ion, metal-ion, metal-insoluble salt anion and redox electrodes, Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes and their applications, standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells–reversible and irreversible cells, conventional representation of electrochemical cells, EMF of a cell and its measurements, Computation of cell EMF, Calculation of thermodynamic quantities of cell reactions (QG, QH and K) Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Definition of pH and pK_a , determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods, Buffers – Mechanism of buffer

action, Henderson- Hazel equation, application of buffer solution, Hydrolysis of salts

VII. Phase Equilibrium:

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibb's phase rule, phase equilibria of one component system- water, 'CO₂' and 'S' systems Phase equilibria of two component system – solid liquid equilibria simple eutectic – Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions – compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (FeCl₃-H₂O) and (CuSO₄-H₂O) system

B.Sc. – Part II (Chemistry Laboratory Practical)

At least three practical from each specialization should be carried out.

Inorganic Chemistry:

I. Calibration of fractional weights, pipettes and burettes, Preparation of standard solutions, Dilution – 0.1 M to 0.001 M solutions.

Quantitative Analysis:

II. Volumetric Analysis:

(a) Determination of acetic acid in commercial vinegar using NaOH.

(b) Determination of alkali content – antacid tablet using HCl.

(c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.

(d) Estimation of hardness of water by EDTA.

(e) Estimation of ferrous and ferric by dichromate method.

(f) Estimation of copper using thiosulphate.

III. Gravimetric Analysis:

Analysis of Cu as CuSCN and Ni as Ni (dimethylglyoxime).

Organic Chemistry

Laboratory Techniques

IV. A. Thin Layer Chromatography

Determination of R_f values and identification of organic compounds:

(a) Separation of green leaf pigments (spinach leaves may be used).

(b) Preparation of separation of 2, 4-dinitrophenylhydrazones of acetone, 2-

butanone, hexan- 2, and 3-one using toluene and light petroleum (40:60)

(c) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5).

V. B. Paper Chromatography: Ascending and Circular

Determination of R_f values and identification of organic compounds:

(a) Separation of a mixture of phenylalanine and glycine, Alanine and aspartic acid, Leucine and glutamic acid, Spray reagent – ninhydrin.

(b) Separation of a mixture of D, L – alanine, glycine, and L-Leucine using *n*-butanol: acetic acid:water (4:1:5), Spray reagent – ninhydrin.

(c) Separation of monosaccharide – a mixture of D-galactose and D-fructose using *n*- butanol:acetone:water (4:5:1), spray reagent – aniline hydrogen phthalate.

VI. Qualitative Analysis:

Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.

Physical Chemistry

VII. Transition Temperature

1. Determination of the transition temperature of the given substance by thermometric /dilatometric method (e.g. $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$ / $\text{SrBr}_2 \cdot 2\text{H}_2\text{O}$).

VIII. Phase Equilibrium

2. To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system.

3. To construct the phase diagram of two components (e.g. diphenylamine – benzophenone) system by cooling curve method.

IX. Thermochemistry

1. To determine the solubility of benzoic acid at different temperatures and to determine Q_H of the dissolution process.

2. To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.

3. To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber Cycle.

**RAJKAMAL SCIENCE & MANAGEMENT COLLEGE
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MATHEMATICS SYLLABUS

For

**UNDER GRADUATE COURSES (B.Sc. Part-II)
(Annual System)**

(Applicable w.e.f. the Session 2019-2020)



Department of Mathematics

**Sridev Suman Uttarakhand University Badshahithaul Tehri-
Garhwal - 249001**

B.Sc. IInd Year MATHEMATICS

NOTE: The question paper consists of three sections A, B and C. Section A will consist 15 objective type questions (all compulsory), each of marks 1. Section B will consist 10 short answered questions in which 5 to be answered, each of marks 4. Section C will consist of 8 long answered questions in which 5 to be answered each of marks 6.

PAPER-1

SUBJECT CODE: BM-201

COURSE TITLE: Differential Equations

- I. First order exacts differential equations. Integrating factors. Rules to find an integrating factor. First order higher degree equations solvable for X, Y, P methods for solving higher order differential equations.
- II. Basic theory of linear differential equations. Wronskian and its properties. Solving a differential equation by reducing its order
- III. Linear homogenous equations with constant coefficients. Linear non homogenous equations, the method of variations of parameters.
- IV. The Cauchy-Euler equation. Simultaneous differential equations. Total differential equations.
- V. Order and degree of partial differential equations. Concept of linear and nonlinear partial differential equations. Formation of first order partial differential equations. Linear partial differential equations of first order. Lagrange's method. Charpit's method.

BOOKS RECOMMENDED:

1. M. Shepley I. Ross. Differential equation 3rd Ed. John wiley & Sons, 1984.
2. I. Sneddon. Elements of partial differential equations. McGraw- Hill. International edition 1967.

PAPER-II

SUBJECT CODE: BM-202

COURSE TITLE: Real Analysis

- I. Finite and infinite sets. Examples of countable and uncountable sets. Real line. Bounded sets. Suprema and Infima. Completeness property of R. Archimedean property of R. Intervals. Concepts of cluster points and statement of Bolzano-Weierstrass theorem

- II. Real sequence. Bounded sequence. Cauchy convergence criterion for sequences. Cauchy's theorem on limits. Order preservations and squeeze theorem. Monotone sequences and their convergence. Monotone convergence theorem without proof.
- III. Infinite series. Cauchy convergence criterion for series. Positive terms series. Geometric series. Comparison test. Convergence of P-series, root test. Ratio test. Alternating series. Leibnitz's test (test of convergence without proof). Definitions and examples of absolute and conditional convergence.
- IV. Rolle's theorem. Mean Value theorem. Taylor's theorem with Lagrange's and Cauchy's forms of remainder. Taylor's series. Maclaurin's series of $\sin X$, $\cos X$, e^x , $\log(1+X)$, $(1+X)^m$.
- V. Sequences and series of function. Point wise and uniform convergence. Mn-test. M-test. Statement of the results about uniform convergence and inerrability and differentiability of function. Power series and radius of convergence.

BOOKS RECOMMENDED:

1. T.M. Apostol, Calculus (vol 1), John Wiley & Sons (Asia) P.Ltd. 2002.
2. R. G. Bartle & D. R. Sherbert. Introduction to Real Analysis, John Wiley & Sons (Asia) P.Ltd. 2002
3. K.A.Ross. Elementary Analysis- The Theory of Calculus Series- Undergraduate Text in Mathematics, Springer Verlag, 2003.
4. Text in Mathematics, Springer Verlag, 2003

PAPER-III**SUBJECT CODE: BM-203****COURSE TITLE: Advance Algebra**

- I. Cayley's theorem. Normalize & center of a group
- II. Normal sub groups & their properties. Simple group.
- III. Rings, Various types of rings. Subrings, properties of rings.
- IV. Ideals, Principal ideal ring. Quotient rings. Characteristics of a ring
- V. Integral Domain, Field, Skew field: Examples & its characterizations.

BOOKS RECOMMENDED:

1. John B.Fraleigh, A first course in Abstract Algebra, 7th Edition Pearson,2002.
2. Joseph A. Gallian, Contemporary Abstract Algebra,4th Edition Narosa,1999.
3. Khanna & Bhambhari, A course in Abstract Algebra, 4th Edition, Vikas Pb. 2006.

RAJKAMAL SCIENCE & MANAGEMENT COLLEGE
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PHYSICS SYLLABUS

For

UNDER GRADUATE COURSES (B.Sc. Part-II)
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Department of Physics

Sridev Suman Uttarakhand University Badshahithaul Tehri-
Garhwal – 249001

PAPER-I: THERMAL PHYSICS AND STATISTICAL MECHANICS**UNIT I: Thermodynamical concept and First Law of Thermodynamics:**

Thermodynamic Description of system, Equilibrium and thermodynamic variables of a system, Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between C_P & C_V , Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient,

UNIT II: Second and Third Law of Thermodynamics:

Inadequacy of first law of thermodynamics, Reversible & irreversible processes, Principle of heat engine and refrigerator, Second law of thermodynamics & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

UNIT III: Thermodynamic Potentials:

Enthalpy, Gibbs free energy, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, Clausius- Clapeyron Equation, Expression for $(C_P - C_V)$, C_P/C_V , TdS equations.

UNIT IV: Kinetic Theory of Gases:

Derivation of Maxwell's law of distribution of velocities and its experimental verification, mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

UNIT V: Theory of Radiation:

Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

Reference Books:

- Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
- A Treatise on Heat, Meghnad Saha, and B. N. Srivastava, 1969, Indian Press.

- Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
- Thermodynamics, Kinetic theory & Statistical thermodynamics, F. W. Sears & G.L.Salinger. 1988, Narosa
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- Statistical Mechanics, Gupta Kumar, Pragati Prakashan.
- Statistical Mechanics, Satyaprakash, Kedar Nath Ram Nath and Sons.
- Statistical Mechanics, E. S. Rajgopal
- Statistical Physics, F. Rief, Mcgraw Hill.

PAPER-II: OPTICS

UNIT I: Geometrical Optics:

Fermat's Principle: Principle of extremum path and its application to deduce laws of reflection and refraction, Aplanatic points of a sphere, Gauss's general theory of image formation: Coaxial symmetrical system, Cardinal points of an optical system, general relationship, thick lens and lens combinations, Lagrange equation of magnification, telescopic combinations, telephoto lens.

UNIT II: Optical Instruments:

Entrance and exit pupils, need for a multiple lens eyepiece, Ramsden's, Hygen's and Gaussiaqn eyepieces, Astronomical refracting telescope, Spectrometer, Aberrations in images: Chromatic aberrations, achromatic combination of lenses in contact and separated lenses, Monochromatic aberrations and their reduction: aspherical mirrors and Schmidt corrector plates, aplanatic points, oil immersion objectives meniscus lens.

UNIT III: Interference of Light:

The principle of superposition, two slit interferences, coherence requirement for the sources, optical path retardations.

Division of amplitude and division of wavefront, Fresnel's Biprism, Phase change on reflection: Stokes' treatment,

Interference in Thin Films: parallel and wedge-shaped films, Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes), Newton's Rings: measurement of wavelength and refractive index.

Michelson's Interferometer: Idea of formation of fringes and its application for determination of wavelength, Wavelength difference, Refractive index, Visibility of fringes. Fabry Perot interferometer.

UNIT IV: Diffraction of Light:

Fresnel Diffraction: Half-period zones, Zone plate, Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.

Fraunhofer diffraction: Diffraction of a Single slit; Double Slit, Multiple slits and Diffraction grating.

UNIT V: Polarization of Light

Transverse nature of light waves, Concept of Plane polarized light – production and analysis, Malus law, Brewster's law, Nicol prism, Circular and elliptical polarization, Double refraction. Optical rotation: Rotation of plane of polarization, origin of optical rotation in liquids and in crystals, polarimeter, half shade and biquartz.

Reference Books:

- Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
- Principles of Optics, B. K. Mathur, 1995, Gopal Printing
- Fundamentals of Optics, H. R. Gulati and D.R. Khanna, 1991, R. Chand Publication
- A Textbook of Optics, N. Subramanyam and Brijlal.
- Optics and Atomic Physics, D. P. Khandelwal.
- Physical Optics, A. K. Ghatak.
- Optics, Eugene Hecht, Pearson Publishers.
- Optics, Satya Prakash.

PAPER-III: SOLID STATE PHYSICS

UNIT I: Crystal Structure

Solids: Amorphous and Crystalline Materials, Lattice with a Basis – Central and Non-Central Elements, Bravais lattice and primitive vectors, Lattice Translation Vectors, Unit Cell (primitive, Wigner-Seitz cell and non-primitive), Seven crystal systems and Fourteen Bravais lattices, sc, bcc and closed packed structures (fcc, hcp and diamond structures), Sodium chloride, Cesium chloride and Zinc blende structures.

Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor.

UNIT II: Reciprocal Lattice

Reciprocal lattice: Definitions, examples and properties, Reciprocal lattice as Bravais lattice, Brillouin Zones, Reciprocal lattice of sc, bcc and fcc lattices, Lattice planes and Miller indices, X-Ray Diffraction, Bragg's law, Laue, powder and rotating crystal methods of X-ray diffraction, Introductory electron and neutron diffraction.

UNIT III: Elementary Lattice Dynamics

Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains, Acoustical and Optical Phonons, Qualitative Description of the Phonon Spectrum in Solids, Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids, T^3 law

UNIT IV: Free Electron Theory of Metals

The outstanding properties of metals, Outline and limitation of Lorentz- Drude Theory, Thermal conductivity, Electrical conductivity, Widemann- Franz relation, Sommerfeld theory of free electrons, Electrical conductivity and Ohms law, Electronic specific heat, Thermoionic emission, escape of electrons from metal, Failures of the free electron Model.

UNIT V Elementary band theory

Kronig Penny model, Band Gaps, Distinction between Conductors, Semiconductors and insulators, intrinsic and extensive semiconductors, P and N type Semiconductors, Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient.

Reference Books:

- Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
- Elements of Solid-State Physics, J. P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
- Solid State Physics, Neil W. Ashcroft and N. David Mermin, 1976, Cengage Learning
- Solid-state Physics, H. Ibach and H Luth, 2009, Springer
- Elementary Solid-State Physics, 1/e M. Ali Omar, 1999, Pearson India
- Solid State Physics, M.A. Wahab, 2011, Narosa Publications

B.Sc. Part-II PHYSICS PRACTICAL LIST

(Any Sixteen Experiments as per facilities in the Institution)

1. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
2. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
3. To determine Stefan's Constant.
4. To verify Newton's Law of Cooling.
5. To determine J by Joule's calorimeter.
6. To verify the laws of probability distribution throwing one coin, two coin and ten coin.
7. To show that deviation of probability from theoretical value decreases with increase in number of events.
8. Study of statistical distribution from the given data and to find most probable, average and rms value.
9. Study of random decay of nuclear disintegration and determination of decay constant using dices.

10. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
11. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
12. To determine the Coefficient of Thermal Conductivity of rubber tube.
13. To determine the Coefficient of Thermal Conductivity of glass.
14. Measurement of Planck's constant using black body radiation.
15. Familiarization with Schuster's focussing; determination of angle of prism by Mercury Lamp.
16. To determine the Refractive Index of the Material of a given Prism using Mercury Light.
17. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
18. To determine wavelength of sodium light using Newton's Rings.
19. To determine the cardinal points of a combination of lenses using nodal slide arrangement.
20. To determine the resolving power of a telescope.
21. To determine specific rotation of cane sugar by polarimeter.
22. To determine refractive index of calcite prism.
23. To determine wavelength of Mercury light using plane diffraction Grating.
24. To investigate the motion of coupled oscillators.
25. To determine the value of Cauchy Constants of a material of a prism.
26. To determine the Resolving Power of a Prism.
27. To determine wavelength of sodium light using Fresnel Biprism.
28. To determine the wavelength of Laser light using Diffraction of Single Slit.
29. To determine wavelength of Sodium light using plane diffraction Grating.
30. To determine the Resolving Power of a Plane Diffraction Grating.

Reference Books:

- Advanced Practical Physics for students, B. L. Flint & H. T. Worsnop, 1971, Asia Publishing House.
 - Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
 - A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- A Laboratory Manual of Physics for Undergraduate Classes, D. P. Khandelwal, 1985, Vani Publication