Name of Teacher – Dr. Surender Kumar **Subject – PHYSICS**

Paper – Semiconductor Devices

Class – B.Sc. 2nd Semester **Session 2023-24**

Weeks With Months	Contents
January 31 and February 1-3	Unit I: Vector Background and Electric Field: Gradient of a scalar and its physical significance, Line, Surface and Volume integrals of a vector and their physical significance.
February 5-10	Flux of a vector field, Divergence and curl of a vector and their physical significance, Gauss's divergence theorem, Stoke's theorem. Conservative nature of Electrostatic Field
February 12-17	Electrostatic Potential, Potential as line integral of field, potential difference, Derivation of electric field F. from potential as gradient. Derivation of Laplace and Poisson equations.
February 19-24	Electric flux, Gauss's Law, Differential form of Gauss's law and applications of Gauss's law. Mechanical force of charged surface, Energy per unit volume.
February 26-29 March 1-2	Unit 2: Magnetic Field: Biot-Savart law and its simple applications: straight wire and circular loop, Current Loop as a Magnetic Dipole and its Dipole Moment. Ampere's Circuital law and its applications to (1) Solenoid and (2) Toroid, properties of B: curl and divergence,
March 4-9	Magnetic Properties of Matter: Force on a dipole in an external field, Electric currents in Atoms, Electron spin and Magnetic moment, types of magnetic materials.
March 11-16	Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H and M, Electronic theory of dia and para-magnetism, Domain theory of ferromagnetism (Langevin's theory), Cycle of Magnetization- B-H curve and hysteresis loop: Energy dissipation, Hysteresis loss and importance of Hysteresis Curve
March 18-22	Revision & test
March 28-30	Unit-3 Time varying electromagnetic fields: Electromagnetic induction, Faraday's laws of induction and I,enz's Law, Self-inductance, Mutual equations
April 1-6	Displacement current, Maxwell's equations in differential and inductance, Energy stored in a Magnetic field, Derivation of Maxwell's integral form and their physical significance.
April 8-13	Electromagnetic Waves: Electromagnetic waves, Transverse nature of electromagnetic wave.
April 15-20	Problem Discussion and Test of Unit-1 Energy transported by electromagnetic waves, Poynting vector, Poynting's theorem.
April 22-27	Determination of coeff. Of rigidity of wire by Maxwell's needle, Bending of Beam, Cantilever and centrally loaded beam, Youngs modulus for material of beam and Elastic constants of wire by Searle's method
April 29-30 and May 1-4	Problem Discussion and Test of Unit-2 Unit-4 DC current Circuits: Electric currents and current density, Electrical conductivity and Ohm's law (Review)

May 6-11	Kirchhoff's laws for D.C. networks. Alternating Current Circuits: A resonance circuit, Phasor, Complex Reactance and Impedance. Analysis for RL, RC and RLC Circuits,
May 13-15	Series LCR Circuit: (1) Resonance, (2) Power Dissipation (3) Quality Factor and (4) Band Width, Parallel LCR Circuit. Problem Discussion and Test of Unit-4

Name of Teacher – Dr. Surender Kumar **Subject – PHYSICS**
Paper – Wave and Optics-II
Class – B.Sc. 4th Semester **Session 2023-24**

Weeks With Months	Contents
March 28-30	Unit-I: Polarization Polarization: Polarisation by reflection, refraction and scattering, Malus Law, Phenomenon of double refraction, Huygen's wave theory of double refraction (Normal and oblique incidence), Analysis of polarized Light, Nicol prism, Quarter wave plate and half wave plate.
April 1-6	production and detection of (i) Plane polarized light (ii) Circularly polarized light and (iii) Elliptically polarized light. Optical activity, Fresnel's theory of optical rotation, Specific rotation, Polarimeters (half shade and Biquartz)
April 8-13	Unit-II: Fourier analysis Fourier theorem and Fourier series, evaluation of Fourier coefficient, importance and limitations of Fourier theorem, even and odd functions, Fourier series of functions f(x) between (i) 0 to 2pi, (ii) –pi to pi, (iii) 0 to pi, (iv) –L to L
April 15-20	Complex form of Fourier series, Application of Fourier theorem for analysis of complex waves: solution of triangular and rectangular waves, Half and full wave rectifier outputs, Parseval identity for Fourier Series, Fourier integrals.
April 22-27	Unit III: Fourier transforms Fourier transforms and its properties, Application of Fourier transform (i) for evaluation of integrals, (ii) for solution of ordinary differential equations, (iii) to the following functions: 1. f(x)= e x2/2 $\|X\|<a$ 2 . f(x) = 0 $\|X\|>a$
April 29-30 and May 1-4	Geometrical Optics I Matrix methods in paraxial optics, effects of translation and refraction, derivation of thin lens and thick lens formulae, unit plane, nodal planes, system of thin lens Unit-IV: Geometrical Optics II Chromatic, spherical, coma, astigmatism and distortion aberrations and their remedies. Fiber Optics Optical fiber, Critical angle of propagation, Mode of Propagation, Acceptance angle,
May 6-11	Fractional refractive index change. Numerical aperture, Types of optics fiber, Normalized frequency, Pulse dispersion, Attenuation, Applications, Fiber optic Communication. Advantages
May 13-15	Revision & Test

Name of Teacher – Dr. Surender Kumar **Subject – PHYSICS**

Paper – Statistical Physics

Class – B.Sc. 4th Semester **Session 2023-24**

Weeks With Months	Contents
January 31 and February 1-3	Unit –I: Statistical Physics I Microscopic and Macroscopic systems, eventsmutually exclusive, dependent and independent. Probability, statistical probability, A priori Probability and relation between them, probability theorems, some probability considerations, combinations possessing maximum probability, combination possessing minimum probability, Tossing of 2,3 and any number of Coins, Permutations and combinations
February 5-10	Distributions of N (for N= 2,3,4) distinguishable and indistinguishable particles in two boxes of equal size, Micro and Macro states, Thermodynamically probability, Constraints and Accessible states, Statistical fluctuations, general distribution of distinguishable particles in compartments of different sizes
February 12-17	Unit –II: Statistical Physics II Postulates of statistical physics, Phase space, Division of Phase space into cells, three kinds of statistics, basic approach in three statistics. M. B. statistics applied to an ideal gas in equilibrium energy distribution law (including evaluation of σ and β), speed distribution law & velocity distribution law
February 19-24	Expression for average speed, r.m.s. speed, average velocity, r. m. s. velocity, most probable energy & mean energy for Maxwellian Distribution. Numerical and problem discussion. Unit-III: Quantum Statistics Need for Quantum Statistics: Bose Einstein energy distribution law, Application of B.E. statistics to Planck's radiation law
February 26-29 March 1-2	B.E. gas Degeneracy and B.E. Condensation. Fermi Dirac energy distribution law, F.D. gas and Degeneracy, Fermi energy and Fermi temperature, Fermi Dirac energy distribution law, Fermi Dirac gas and degeneracy, Fermi energy and Fermi temperature, Fermi Dirac energy distribution law for electron gas in metals
March 4-9	Zero point energy, Zero point pressure and average speed (at 0 K) of electron gas, Specific heat anomaly of metals and its solution. M.B. distribution as a limiting case of B.E. and F.D. distributions, Comparison of three statistics.
March 11-16	Unit-IV: Theory of Specific Heat of Solids Dulong and Petit law. Derivation of Dulong and Petit law from classical physics.
March 18-22	Specific heat at low temperature, Einstein theory of specific heat, Criticism of Einstein theory, Debye model of specific heat of solids, success and shortcomings of Debye theory, comparison of Einstein and Debye theories. Revision & Test

Name of Teacher – Dr. Surender Kumar **Subject – PHYSICS**
Paper – Solid state and Nano Physics
Class – B.Sc. 6th Semester **Session 2023-24**

Weeks With Months	Contents
January 31 and February 1-3	Unit I: Crystal Structure I Crystalline and glassy forms, liquid crystals, crystal structure, periodicity, lattice and basis, crystal translational vectors and axes. Unit cell and Primitive Cell
February 5-10	Wigner Seitz primitive Cell, symmetry operations for a two-dimensional crystal, Bravais lattices in two and three dimensions. Crystal planes and Miller indices, Interplanar spacing,
February 12-17	Crystal structures of Zinc Sulphide, Sodium Chloride and Diamond, Numerical Problems. Unit II: Crystal Structure II, X ray diffraction, Bragg's Law and experimental X ray diffraction methods
February 19-24	K space and reciprocal lattice and its physical significance, reciprocal lattice vectors, reciprocal lattice to a simple cubic lattice, b.c.c. and f.c.c.
February 26-29 March 1-2	Unit III: Super conductivity Historical introduction, Survey of superconductivity, Super conducting systems, High Tc Super conductors, Isotopic Effect, Critical Magnetic Field, Meissner Effect, London Theory and Pippards' equation
March 4-9	Classification of Superconductors (type I and Type II), BCS Theory of Superconductivity, Flux quantization, Josephson Effect (AC and DC), Practical Applications of superconductivity and their limitations, power application of superconductors.
March 11-16	Unit IV: Introduction to Nano Physics Definition, Length scale, Importance of Nano scale and technology, History of Nanotechnology, Benefits and challenges in molecular manufacturing. Molecular assembler concept, Understanding advanced capabilities. Vision and objective of Nanotechnology, Nanotechnology in different field, Automobile, Electronics, Nano-biotechnology, Materials, Medicine
March 18-22	Revision & Test

Name of Teacher – Dr. Surender Kumar **Subject – PHYSICS**
Paper – Atomic and Molecular spectroscopy
Class – B.Sc. 6th Semester **Session 2023-24**

Weeks With Months	Contents
March 28-30	Unit – I: Historical background of atomic spectroscopy Introduction of early observations, emission and absorption spectra, atomic spectra, wave number, spectrum of Hydrogen atom in Balmer series, Bohr atomic model (Bohr's postulates), spectra of Hydrogen atom , explanation of spectral series in Hydrogen atom, unquantized states and continuous spectra, spectral series in absorption spectra, effect of nuclear motion on line spectra (correction of finite nuclear mass), variation in Rydberg constant due to finite mass.
April 1-6	Short comings of Bohr's theory, Wilson Sommerfeld quantization rule, De-Broglie interpretation of Bohr quantization law, Bohr's corresponding principle, Sommerfeld's extension of Bohr's model, Sommerfeld relativistic correction, Short comings of Bohr Sommerfeld theory, Vector atom model; space quantization, electron spin, coupling of orbital and spin angular momentum, spectroscopic terms and their notation, quantum numbers associated with vector atom model, transition probability and selection rules.
April 8-13	Unit –II: Vector Atom Model (single valance electron) Orbital magnetic dipole moment (Bohr magneton), behavior of magnetic dipole in external magnetic filed; Larmor's precession and theorem. Penetrating and Nonpenetrating orbits, Penetrating orbits on the classical model; Quantum defect,
April 15-20	spin orbit interaction energy of the single valance electron, spin orbit interaction for penetrating and nonpenetrating orbits. quantum mechanical relativity correction, Hydrogen fine spectra, Main features of Alkali Spectra and their theoretical interpretation, term series and limits, Rydeburg Ritze combination principle, Absorption spectra of Alkali atoms. observed doublet fine structure in the spectra of alkali metals and its Interpretation, Intensity rules for doublets, comparison of Alkali spectra and Hydrogen spectrum.
April 22-27	UNIT-III: Vector Atom model (two valance electrons) Essential features of spectra of Alkaline earth elements, Vector model for two valance electron atom: application of spectra. Coupling Schemes; LS or Russell – Saunders Coupling Scheme and JJ coupling scheme, Interaction energy in LS coupling (sp, pd configuration), Lande interval rule, Pauli principle and periodic classification of the elements. Interaction energy in JJ Coupling (sp, pd configuration), equivalent and nonequivalent electrons, Two valance electron system, spectral terms of nonequivalent and equivalent electrons, comparison of spectral terms in LS And JJ coupling.
April 29-30 and May 1-4	Hyperfine structure of spectral lines and its origin; isotope effect, nuclear spin. **Unit –IV**: Atom in External Field Zeeman Effect (normal and Anomalous), Experimental setup for studying Zeeman effect, Explanation of normal Zeeman effect (classical and quantum mechanical), Explanation of anomalous Zeeman effect (Lande g factor),

	Zeeman pattern of D1 and D2 lines of Na atom.
May 6-11	Paschen Back effect of a single valence electron system. Weak field Stark effect of Hydrogen atom. Molecular Physics General Considerations, Electronic States of Diatomic Molecules, Rotational Spectra (Far IR and Microwave Region), Vibrational Spectra (IR Region), Rotator Model of Diatomic Molecule, Raman Effect, Electronic Spectra.
May 13-15	Revision & Test