Government College, Chhachhrauli

Summary of Lesson Plan

Name of Teacher: Dr. Shruti Bhardwaj **Academic Session : 2023-24**

Class : B.Sc. **Semester :** **Subject : Physics: PH-602: Atomic and Molecular Spectroscopy**

Unit	Topic/Chapters to be covered	Duration	Assignment and Tests
1	Historical background of atomic spectroscopy Introduction of early observations, emission and absorption spectra, atomic spectra, wave number.	**01 - 07 Jan**	
1	Explanation of spectral series in Hydrogen atom, un-quantized states and continuous spectra, spectral series in absorption spectra, effect of nuclear motion on line spectra (correction of finite nuclear mass)	**08 - 14 Jan**	
1	variation in Rydberg constant due to finite mass, 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.	**15 - 21 Jan**	
1	coupling of orbital and spin angular momentum, spectroscopic terms and their notation, quantum numbers associated with vector atom model, transition probability and selection rules.	**22-28 Jan**	
2	Vector Atom Model (single valance electron) Orbital magnetic dipole moment (Bohr megnaton), behavior of magnetic dipole in external magnetic filed; Larmors' precession and theorem.	**29 Jan-4 Feb**	
2	Penetrating and Non-penetrating orbits, Penetrating orbits on the classical model; Quantum defect, spin orbit interaction energy of the single valance electron, spin orbit interaction for penetrating and non-penetrating orbits. quantum mechanical relativity correction, Hydrogen fine spectra	**5-11 Feb**	
2	Main features of Alkali Spectra and their theoretical interpretation, term series and limits, Rydeburg-Ritze combination principle, Absorption spectra of Alkali atoms.	**12-18 Feb**	
2	Observed doublet fine structure in the spectra of alkali metals and its Interpretation, Intensity rules for doublets, comparison of Alkali spectra and Hydrogen spectrum .	**19-25 Feb**	

3	Vector Atom model (two valance electrons) Essential features of spectra of Alkaline-earth elements, Vector model for two valance electron atom: application of spectra.	**26 Feb-3 Mar**	
3	Coupling Schemes;LS or Russell – Saunders Coupling Scheme and JJ coupling scheme, Interaction energy in L-S coupling (sp, pd configuration).	**4-10 Mar**	Assignment 1
3	Lande interval rule, Pauli principal and periodic classification of the elements. Interaction energy in JJ Coupling (sp, pd configuration)	**11-17 Mar**	
3	Equivalent and non-equivalent electrons, Two valance electron system-spectral terms of non-equivalent and equivalent electrons, comparison of spectral terms in L-S And J-J coupling. Hyperfine structure of spectral lines and its origin; isotope effect, nuclear spin.	**18-22 Mar**	
	HOLI Break	**23-31 Mar**	
4	Atom in External Field Zeeman Effect (normal and Anomalous),Experimental set-up 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.	**1-7 April**	Test
4	Paschen-Back effect of a single valence electron system. Weak field Stark effect of Hydrogen atom.	**8-14 April**	
4	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.	**15-21 April**	
	Revision	**22-30 April**	

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Summary of Lesson Plan

Name of Teacher: Dr. Shruti Bhardwaj **Academic Session : 2023-24**

Class : B.Sc. **Semester :IV** **Subject : Physics: PH-402: Wave and Optics II**

Unit	Topic/Chapters to be covered	Duration	Assignment and Tests
2	Fourier analysis Fourier theorem and Fourier series, evaluation of Fourier coefficient, importance and limitations of Fourier theorem.	**01 - 07 Jan**	
2	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	**08 - 14 Jan**	
2	Complex form of Fourier series, Application of Fourier theorem for analysis of complex waves:	**15 - 21 Jan**	
2	solution of triangular and rectangular waves.	**22-28 Jan**	
2	Half and full wave rectifier outputs, Parseval identity for Fourier Series, Fourier integrals.	**29 Jan-4 Feb**	
3	Fourier transforms Fourier transforms and its properties	**5-11 Feb**	
3	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 2 . f(x) = 0 |X |>a	**12-18 Feb**	
3	Geometrical Optics II Chromatic, spherical, coma,	**19-25 Feb**	

3	astigmatism and distortion aberrations and their remedies	**26 Feb-3 Mar**	
4	Fiber Optics Optical fiber, Critical angle of propagation, Mode of Propagation, Acceptance angle, Fractional refractive index change.	**4-10 Mar**	
4	Numerical aperture, Types of optics fiber, Normalized frequency, Pulse dispersion, Attenuation,	**11-17 Mar**	Assignment 1
4	Applications, Fiber optic Communication, Advantages.	**18-22 Mar**	
	HOLI Break	**23-31 Mar**	
1	Polarization Polarization: Polarisation by reflection, refraction and scattering, Malus Law.	**1-7 April**	Test
1	Phenomenon of double refraction, Huygen's wave theory of double refraction (Normal and oblique incidence)	**8-14 April**	
1	Analysis of polarized Light. Nicol prism, Quarter wave plate and half wave plate, production and detection of (i) Plane polarized light (ii) Circularly polarized light and (iii) Elliptically polarized light.	**15-21 April**	
1	Optical activity, Fresnel's theory of optical rotation, Specific rotation, Polarimeters (half shade and Biquartz).	**22-30 April**	

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Summary of Lesson Plan

Name of Teacher: Dr. Shruti Bhardwaj **Academic Session : 2023-24**

Class : B.Sc. **Semester : Ist** **Subject : Electricity, Magnetism and EM Theory**

Unit	Topic/Chapters to be covered	Duration	Assignment and Tests
4	Alternating Current Circuits and Network Theorems: Electric current and current density, Electrical-conduclivity and Ohm's law (Review), Alternating Current Circuits: A resonance circuit, Phasor, Complex	**15-18 Feb**	
4	Reactance and Impedance, Analysis for RL, RC and LC Circuits,	**19-25 Feb**	
4	Series LCR Circuit: (1) Resonance, (2) Power Dissipation (3) Quality Factor and (4) Band Width, Parallel LCR Circuit.	**26 Feb-3 Mar**	
4	Kirchhof's laws for D.C. networks	**4-10 Mar**	
4	Network Theorems: Thevenin's Theorem, Norton theorem. Superposition Theorem.	**11-17 Mar**	
3	Time Varying Electromagnetic Fields: Electromagnetic induction Faraday's laws of induction and Lenz's Law, Self-inductance, Mutual inductance, Energy stored in a Magnetic field, Derivation of Maxwell's equations, Displacement current, Maxwell's equations in differential and integral form and their physical significance.	**18-22 Mar**	Assignment 1

	HOLI Break	**23-31 Mar**	
3	Electromagnetic Waves: Electromagnetic waves, Transverse nature of electromagnetic wave, energy transported by electromagnetic waves,	**1-7 April**	Test
3	Poynting vector, Poynting's theorem. Propagation of Plane electromagnetic waves in free space & Dielectrics	**8-14 April**	
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.	**15-21 April**	
2	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, Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H and M, Electronic theory of dia and paramagnetism. Domain theory of ferromagnetism (Langevin's theory), Cycle of Magnetization-B-H curve ind hysteresis loop: Energy dissipation. Hysteresis loss and importance of Hysleresis Curve	**22-30 April**	

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Summary of Lesson Plan

Name of Teacher: Dr. Sandeep Kumar **Academic Session : 2023-24**

Class : B.Sc. **Semester : Ist** **Subject : Electricity,Magnetism and EM Theory**

Unit	Topic/Chapters to be covered	Duration	Assignment and Tests
	Vector Background and Electric Field:	**15-18 Feb**	
	Gradient of a scalar and its physical significance	**19-25 Feb**	
	Line, Surface and Volume integrals of a vector and their physical significance	**26 Feb-3 Mar**	
	Flux of a vector field. Divergence and curl of a vector and thieir physical significance	**4-10 Mar**	
	Gauss's divergence theorem.	**11-17 Mar**	
	Stoke's theorem.	**18-22 Mar**	Assignment 1
	HOLI Break	**23-31 Mar**	
	Conservative nature of Electrostatic Field, Electrostatic Potential	**1-7 April**	Test
	Potential as line integral of field, potential difference Derivation of electric field E from potential as gradient. Derivation of Laplace and Poisson equations.	**8-14 April**	

	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.	**15-21 April**	
	Revision	**22-30 April**	

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Summary of Lesson Plan

Name of Teacher: Dr. Sandeep Kumar **Academic Session : 2023-24**

Class : B.Sc. **Semester : VI** **Subject : Physics**

Unit	Topic/Chapters to be covered	Duration	Assignment and Tests
1	Crystal Structure I Crystalline and glassy forms	**01 - 07 Jan**	
1	liquid crystals, crystal structure	**08 - 14 Jan**	
1	periodicity, lattice and basis	**15 - 21 Jan**	
1	crystal translational vectors and axes. Unit cell and Primitive Cell, Winger Seitz primitive Cell	**22-28 Jan**	
1	Symmetry operations for a two dimensional crystal	**29 Jan-4 Feb**	
1	Bravais lattices in two and three dimensions.	**5-11 Feb**	
1	Crystal planes and Miller indices, Interplaner spacing	**12-18 Feb**	
1	Crystal structures of Zinc Sulphide, Sodium Chloride and Diamond.	**19-25 Feb**	Assignment on Crystal Structures

2	Crystal Structure II X-ray diffraction, Bragg's Law and experimental X-ray diffraction methods. K-space and reciprocal lattice and its physical significance	**26 Feb-3 Mar**	
2	reciprocal lattice vectors, reciprocal lattice to a simple cubic lattice, b.c.c. and f.c.c.	**4-10 Mar**	
3	Super conductivity Historical introduction, Survey of superconductivity, Super conducting systems, High Tc Super conductors, Isotopic Effect, Critical Magnetic Field	**11-17 Mar**	
3	Meissner Effect, London Theory and Pippards' equation, Classification of Superconductors (type I and Type II), BCS Theory of Superconductivity, Flux quantization,	**18-22 Mar**	
	HOLI Break	**23-31 Mar**	
4	Josephson Effect (AC and DC), Practical Applications of superconductivity and their limitations, power application of superconductors. Test	**1-7 April**	Test of Syllabus Covered till 22 March
4	Introduction to Nano Physics Definition, Length scale, Importance of Nano-scale and technology, History of Nantechnology	**8-14 April**	
4	Benefits and challenges in molecular manufacturing. Molecular assembler concept, Understanding advanced capabilities. Vision and objective of Nano-technology, Nanotechnology in different field,	**15-21 April**	
4	Automobile, Electronics, Nano-biotechnology, Materials, Medicine. Revision & Test	**22-30 April**	Test of Unit III & IV

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Summary of Lesson Plan

Name of Teacher: Dr. Sandeep Kumar **Academic Session : 2023-24**

Class : B.Sc. **Semester : IV** **Subject : Physics**

Unit	Topic/Chapters to be covered	Duration	Assignment and Tests
1	Statistical Physics I Microscopic and Macroscopic systems, events-mutually exclusive, dependent and independent. Probability, statistical probability,	**01 - 07 Jan**	
1	A- priori Probability and relation between them, probability theorems, some probability considerations	**08 - 14 Jan**	
1	combinations possessing maximum probability, combination possessing minimum probability, Tossing of 2,3 and any number of Coins, Permutations and combinations distributions of N (for N= 2,3,4) distinguishable and indistinguishable particles in two boxes of equal size,	**15 - 21 Jan**	
1	Micro and Macro states, Thermodynamical probability, Constraints and Accessible states.	**22-28 Jan**	
1	Statistical fluctuations, general distribution of distinguishable particles in compartments of different sizes.	**29 Jan-4 Feb**	
1	Condition of equilibrium between two systems in thermal contact-- β parameter, Entropy and Probability (Boltzman's relation).	**5-11 Feb**	
2	Statistical Physics II Postulates of statistical physics, Phase space,	**12-18 Feb**	
2	Division of Phase space into cells, three kinds of statistics, basic approach in three statistics.	**19-25 Feb**	

2	M. B. statistics applied to an ideal gas in equilibrium- energy distribution law (including evaluation of σ and β).	**26 Feb-3 Mar**	Assignment on B.E & F.D Statistics.
2	speed distribution law & velocity distribution law. Expression for average speed, r.m.s. speed, average velocity, r. m. s. velocity, most probable energy & mean energy for Maxwellian distribution.	**4-10 Mar**	
3	Quantum Statistics Need for Quantum Statistics: Bose-Einstein energy distribution law, Application of B.E. statistics to Planck's radiation law B.E. gas	**11-17 Mar**	
3	Degeneracy and B.E. Condensation, FermiDirac energy distribution law, F.D. gas and Degeneracy, Fermi energy and Fermi temperature, Fermi Dirac energy distribution law	**18-22 Mar**	
	HOLI Break	**23-31 Mar**	
3	Fermi Dirac gas and degeneracy, Fermi energy and Fermi temperature, Fermi Dirac energy distribution law for electron gas in metals, 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. Test.	**1-7 April**	Test of Syllabus Covered till 22 March
4	Theory of Specific Heat of Solids Dulong and Petit law. Derivation of Dulong and Petit law from classical physics.	**8-14 April**	
4	Specific heat at low temperature, Einstein theory of specific heat, Criticism of Einstein theory Debye model of specific heat of solids,	**15-21 April**	
4	success and shortcomings of Debye theory, comparison of Einstein and Debye theories.	**22-30 April**	Revision & Test of Unit III & IV.