LESSON PLAN–PHYSICS

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Class & Section: B.Sc. III Year: 6th Sem (CS & NM)

Subject: Atomic and Molecular Spectroscopy

Lesson Plan: 16 Weeks (From January,2025 to April, 2025).

Week–1,2,3,4		
Unit– 1 Historical Background of atomic spectroscopy		
WEEK	DAY	TOPIC
1	1	Introduction to early observations, emission and absorption spectra, atomic spectra
	2	Wave number, Spectrum of hydrogen atom in Balmer Series
	3	Bohr atomic model (Bohr's Postulates), Spectra of Hydrogen atom
	4	Introduction to early observations, emission and absorption spectra, atomic spectra
	5	Wave number, Spectrum of hydrogen atom in Balmer Series
	6	Bohr atomic model (Bohr's Postulates), Spectra of Hydrogen atom
2	1	Explanation of spectral series in hydrogen atom, un-quantized states and continuous spectra
	2	Spectral series in absorption spectra, effect of nuclear motion on line spectra (correction of finite nuclear mass)
	3	Variation in Rydberg constant due to finite mass, short comings of Bohr's theory
	4	Explanation of spectral series in hydrogen atom, un-quantized states and continuous spectra
	5	Spectral series in absorption spectra, effect of nuclear motion on line spectra (correction of finite nuclear mass)
	6	Variation in Rydberg constant due to finite mass, short comings of Bohr's theory
3	1	Wilson sommerfeld quantization rule, de-Broglie interpretation of Bohr quantization law
	2	Bohr's corresponding principle, Short comings of Bohr-Sommerfeld theory
	3	Vector atom model; space quantization, electron spin
	4	Wilson sommerfeld quantization rule, de-Broglie interpretation of Bohr quantization law
	5	Bohr's corresponding principle, Short comings of Bohr-Sommerfeld theory
	6	Vector atom model; space quantization, electron spin
4	1	Coupling of orbital and spin angular momentum
	2	Spectroscopic terms and their notation, quantum numbers associated with vector atom model

	3	Transition Probability and selection rules
	4	Coupling of orbital and spin angular momentum
	5	Spectroscopic terms and their notation, quantum numbers associated with vector atom model
	6	Transition Probability and selection rules

Week–5,6,7,8		
Unit– 2 Vector Atom Model (Single Valance Electron)		
WEEK	DAY	TOPIC
5	1	Orbital magnetic dipole moment (Bohr magneton), behavior of magnetic dipole in external magnetic field
	2	Larmor's precession and theorem
	3	Penetrating and non-penetrating orbits, penetrating orbits on the classical model; quantum defect
	4	Orbital magnetic dipole moment (Bohr magneton), behavior of magnetic dipole in external magnetic field
	5	Larmor's precession and theorem
	6	Penetrating and non-penetrating orbits, penetrating orbits on the classical model; quantum defect
6	1	Spin orbit interaction energy of the single valance electron
	2	Spin orbit interaction for penetrating and non-penetrating orbits
	3	Quantum mechanical relativity correction, Hydrogen fine spectra
	4	Spin orbit interaction energy of the single valance electron,
	5	Spin orbit interaction for penetrating and non-penetrating orbits
	6	Quantum mechanical relativity correction, Hydrogen fine spectra
7	1	Main features of Alkali Spectra and their theoretical interpretation
	2	Term series and limits, Rydberg-Ritz combination principle
	3	Absorption spectra of Alkali atoms
	4	Main features of Alkali Spectra and their theoretical interpretation
	5	Term series and limits, Rydberg-Ritz combination principle
	6	Absorption spectra of Alkali atoms
8	1	Observed doublet fine structure in the spectra of alkali metals and its Interpretation
	2	Intensity rules for doublets
	3	Comparison of Alkali spectra and Hydrogen spectrum.
	4	Observed doublet fine structure in the spectra of alkali metals and its Interpretation
	5	Intensity rules for doublets
	6	Comparison of Alkali spectra and Hydrogen spectrum

Week–9,10,11,12		
Unit– 3 Vector Atom Model (Two Valance Electron)		
WEEK	DAY	TOPIC
9	1	Essential features of spectra of Alkaline-earth elements
	2	Vector model for two valance electron atom: application of spectra
	3	Coupling Schemes; LS or Russell – Saunders Coupling Scheme
	4	Essential features of spectra of Alkaline-earth elements
	5	Vector model for two valance electron atom: application of spectra
	6	Coupling Schemes; LS or Russell – Saunders Coupling Scheme
10	1	JJ coupling scheme Lande interval rule
	2	Interaction energy in L-S coupling (sp, pd configuration)
	3	Pauli principal and periodic classification of the element
	4	JJ coupling scheme Lande interval rule
	5	Interaction energy in L-S coupling (sp, pd configuration)
	6	Pauli principal and periodic classification of the element
11	1	Interaction energy in JJ Coupling (sp, pd configuration)
	2	Equivalent and non-equivalent electrons
	3	Two valance electron system-spectral terms of non-equivalent and equivalent electrons
	4	Interaction energy in JJ Coupling (sp, pd configuration)
	5	Equivalent and non-equivalent electrons
	6	Two valance electron system-spectral terms of non-equivalent and equivalent electrons
12	1	Comparison of spectral terms in L-S and J-J coupling
	2	Hyperfine structure of spectral lines and its origin
	3	Isotope effect, nuclear spin
	4	Comparison of spectral terms in L-S and J-J coupling
	5	Hyperfine structure of spectral lines and its origin
	6	Isotope effect, nuclear spin

Week- 13,14,15,16		
Unit – 4 Atom in External Field and Molecular Physics		
WEEK	DAY	TOPIC
13	1	Zeeman Effect (normal and Anomalous)
	2	Experimental set-up for studying Zeeman effect
	3	Explanation of normal Zeeman effect(classical and quantum mechanical)
	4	Zeeman Effect (normal and Anomalous)
	5	Experimental set-up for studying Zeeman effect
	6	Explanation of normal Zeeman effect(classical and quantum mechanical)
14	1	Explanation of anomalous Zeeman effect (Lande g-factor)
	2	Zeeman pattern of D1 and D2 lines of Na atom
	3	Paschen-Back effect of a single valence electron system
	4	Explanation of anomalous Zeeman effect (Lande g-factor)
	5	Zeeman pattern of D1 and D2 lines of Na atom
	6	Paschen-Back effect of a single valence electron system
15	1	Weak field Stark effect of Hydrogen atom
	2	General Considerations in molecular physics, Electronic States of Diatomic Molecules,
	3	Rotational Spectra (Far IR and Microwave Region)
	4	Weak field Stark effect of Hydrogen atom
	5	General Considerations in molecular physics, Electronic States of Diatomic Molecules,
	6	Rotational Spectra (Far IR and Microwave Region)
16	1	Vibrational Spectra (IR Region)
	2	Rotator Model of Diatomic Molecule
	3	Raman Effect, Electronic Spectra.
	4	Vibrational Spectra (IR Region)
	5	Rotator Model of Diatomic Molecule
	6	Raman Effect, Electronic Spectra