Syllabus for B.Sc. Semester V
Optional Physics
PHY 501: Paper -5.1: Atomic & Molecular Physics

Total hours of teaching : 42hrs

1. **Basic Properties of Atom** **8 hrs**

Constitution of atom and its properties, Determination of charge of the electron by Millikan's oil drop method. Determination of specific charge of the electron by J.J. Thomson's method. Atomic mass determination by Dempster's method and atomic mass unit.

2. **Atomic models** **8 hrs**

Review of Thompson and Rutherford models, alpha scattering experiment – concept of impact parameter (qualitative). Bohr's theory of hydrogen atom and its inadequacies, effect of nuclear mass, Somerfield model – qualitative. Excitation and ionization energies and their potentials. Frank –Hertz experiment.

3. **Vector atom model** **10 hrs**

Concept of spatial quantization, spinning electron hypothesis, quantum number. Pauli's exclusion principle. Fine structure of spectral lines; Stern and Gerlach experiment; degeneracy associated with magnetic quantum number. Selection rules. Coupling schemes LS and JJ-coupling for a pair of electrons. Zeeman effect; experimental study, quantum theory of normal and anomalous zeeman effect, Stark effect (qualitative).

4. **Molecular spectra** **6 hrs**

Introduction to molecular spectra. Classification of molecular spectra. Eigen value expressions for rotational, vibrational and electronic spectra of diatomic molecules. Band structure of diatomic molecules. Fluorescence and phosphorescence phenomenon.

5. **Raman effect** **4 hrs**

Coherent and incoherent scattering, Rayleigh scattering, Raman effect Experimental study, classical and quantum theory. application of Raman effect- determination of force constant, bond length of diatomic molecule and structure of tri-atomic molecule.

6. **LASERS** **6 hrs**

Definition of laser, properties of lasers, Ideas of Induced absorption, spontaneous emission and stimulated emission. Expression for Einstein's coefficients. population inversion, electrical and optical pumping techniques used to achieve population inversion,construction and working of solid state laser (Ruby), Gas laser (He-Ne), Semiconductor lasers (intrinsic and doped). Applications of lasers. Principle of Holography.

Reference books

1. Statistical Mechanics by K Huang.
2. Statistical Mechanics by S.L.Gupta & V. Kumar
3. Concepts of Modern Physics by Arthur Beiser, Tata McGraw-Hill pubs.
4. Modern Physics by B.V.N. Rao
5. Modern Physics by Murugeshan
6. Electronic devices and circuits by Jacob Millman & Halkias
7. Fundamentals of Electronics by B. Basavaraj
8. Modern Physics, Vol-II B by Basavaraj, Omkar Publications
9. Concept of Modern Physics by S.L Gupta and S.Gupta

PHYL5.1: Practical course for Semester V

Instructions

1. Two experiments (3 hours duration each) per week should be performed.
2. One practical internal test of 3 hours duration for 15 marks be conducted at the end of practical course in the semester.
3. Minimum of 6 experiments should be performed in semester V.

List of experiments

1. Determination of energy band gap of a semiconductor.
2. Forward and reverse biased characteristics of a PN –junction diodedetermination of forward resistance and Reverse
3. Characteristics of a zener diode-determine Zener breakdown voltage
4. Half wave and full rectifiers- study input and output waveforms and determine ripple factors.
5. Unregulated power supply –shunt capacitor filter. Series inductor filter and comparison of ripple factors.
6. Regulated power supply using Zener diode. - Line regulation and load regulation.
7. Characteristics of LED (three different colours).
8. Characteristics of photodiode.
9. Characteristics of a solar cell – determination of fill factor.
10. Input, output and transfer characteristics of a transistor in CB Configuration.
11. Determination of Rydberg constant using H_2-source and spectrometer
12. Temperature of flame by line reversal method.
13. Capacitance of reverse biased semiconductor diode.
14. Estimation of chlorophil in plant cell
15. Mapping of H-R diagrams
16. Fermi energy of copper by four –probe point method.