Programme	Bachelor of Science in Solid State Physics (BS SS Physics)	**Course Code**	**SSP-402**	**Credit Hours**	3 (2-1)
Course Title	**Atomic and Molecular Physics**				

Course Introduction

This course is designed:

To review the existing theories of atomic structure

To introduce the experimental proof of quantization

To introduce the use of Schrodinger Equation in real system like Hydrogen atom

To understand the Molecular spectrum

Learning Outcomes

By the end of this course, students will be able to:

1. Describe the atomic spectra of one and two valance electron atoms.
2. Explain the change in behavior of atoms in external applied electric and magnetic field.
3. Explain rotational, vibrational, electronic and Raman spectra of molecules.
4. Describe electron spin and nuclear magnetic resonance spectroscopy and their applications.

	Course Content	**Assignments/Readings**
Week 1	**Unit-I** a. Structure of Atoms 1.1.1 Review of Bohr's theory.	Postulates of Bohr's theory
Week 2	**Unit-II** 2.1 Sommerfeld model	Postulates of Sommerfeld theory
Week 3	**Unit-III** 3.1 Frank Hertz experiment and approximation methods	What were the observations of frank hertz experiments?
Week 4	**Unit-IV** a. One Electron System b. Review of Schrodinger equation for hydrogen atom	Schrodinger equation
Week 5	**Unit-V** 5.1 Fermi Golden rule, Quantum numbers, Atoms in radiation field	What are quantum numbers?
Week 6	**Unit-VI**	What is Stark effect?

	6.1 Radiative transitions, Einstein coefficients, Selection rules, normal Zeeman effect, Hyperfine structure.	
Week 7	**Unit-VII** 7.1 Many body Systems 7.1.1 Pauli exclusion principle, Periodic system of the elements	
Week 8	Mid Term Exams	
Week 9	**Unit-VIII** 8.1 Stern Gerlach experiment, Spin orbit coupling, Central field approximation	Practice
Week 10	**Unit-IX** 9.1 Hartree Fock methods and self-consistent field	Solve exercise
Week 11	**Unit-X** 10.1 Thomas Fermi potential, LS coupling, jj coupling and other type of coupling, X-ray spectra.	What is LS coupling?
Week 12	**Unit-XI** 11.1 Interaction with field 11.1.1 Many electron atoms in an electromagnetic field, Anomalous Zeeman effect, Paschen back effect, Stark effect	Applications of Zeeman effect
Week 13	**Unit-XII** 12.1 Molecules 12.1.1 Ionic and covalent bonding, Diatomic molecules-rotational, vibrational, and electronic spectra	What is atomic bonding?
Week 14	**Unit-XIII** 13.1 Born Oppenhimer approximation, Transition probabilities of diatomic molecules, electron spin and Hund's cases, Polyatomic molecules (brief introduction)	Exercise
Week 15	**Unit-XIV** 14.1 Raman effect, Hydrogen Molecular ion (LCAO approximation), Hydrogen molecule (Heitler London and molecular orbital theories)	Presentations
Week 16	Final Term Exams	
Textbooks and Reading Material		

1. Anne P. Thorn, Spectrophysics, second edition, Chapman and Hall, 1988.

2. B. H. Bransden and C.J. Joachain, Physics of atomic and Molecules, Longmans, London 1983,

3. R. Eisberg, and R. Resnick, Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, second edition, John Wiley and sons 1985.

Teaching Learning Strategies

1. Course Teaching
2. Presentations
3. Quiz

Assignments: Types and Number with Calendar

1.
2.
3.
4.

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.