Course Specifications

General Information

Course name	Atomic&Molecular Physics
Course number	PHYS4325
Faculty	
Department	
Course type	College Needs
Course level	4
Credit hours (theoretical)	3
Credit hours (practical)	0
Course Prerequisites	

Course Objectives

1 - Understanding and Knowledge of atomic models and structure

2 - Understanding of Schrodinger equation based solution for hydrogen atom, probability density and orbital angular momentum

3 - Understanding and knowledge of magnetic dipole moment, spin, spin orbit interaction and transition rate

4 - Understanding of spectrum one electron atom and Hydrogen

5 - Understanding and knowledge of electronic structure, quantum numbers and Hydrogen –like atom, helium atom and multi electron atoms

6 - Understanding of atomic spectrum in external magnetic field and Zeeman effect

7 - Understanding and knowledge of the electronic structure of molecules, ionic and covalent bonds

8 - Understanding and knowledge of the molecular spectra, rotational, vibrational, rotational-vibrational spectrum and Raman effect

Intended Learning Outcomes

Knowledge and Understanding

* Understanding the principles of atomic physics and its role in physics development
* To promotes the understanding of, and concretizes the importance of quantum mechanics
* shows how our world works on a microscopic scale
* To realize that atomic and molecular physics is the basis to understand e .g. condensed matter, nuclear physics and particle physics

Course Contents

1 - chapter 1: Models 1- THOMSONS MODEL, RUTHERFORDS MODEL, THE STABILITY OF THE NUCLEAR ATOM, ATOMIC SPECTRA, BOHRS POSTULATES, BOHRS MODEL, CORRECTION FOR FINITE NUCLEAR MASS 2- ATOMIC ENERGY STATES 3- INTERPRETATION OF THE QUANTIZATION RULES 4- SOMMERFELDS MODEL 5- THE CORRESPONDENCE PRIN

2 - chapter 2: ONE-ELECTRON ATOMS 1- DEVELOPMENT OF THE SCHROEDINGER EQUATION , SEPARATION OF THE TIME-INDEPENDENT EQUATION , SOLUTION OF THE EQUATIONS , EIGENVALUES, QUANTUM NUMBERS, AND DEGENERACY, EIGENFUNCTIONS 2- PROBABILITY DENSITIES 3- ORBITAL ANGULAR MOMENTUM

3 - chapter 3:MAGNETIC DIPOLE MOMENTS, SPIN, AND TRANSITION RATES 1- ORBITAL MAGNETIC DIPOLE MOMENTS 2- THE STERN-GERLACH EXPERIMENT AND ELECTRON SPIN 3- TOTAL ANGULAR MOMENTUM 4- SPIN-ORBIT INTERACTION ENERGY AND THE HYDROGEN ENERGY LEVELS 5- TRANSITION RATES AND SELECTION RULES

4 - chapter 4: MULTIELECTRON ATOMS-OPTICAL EXCITATIONS 1- ALKALI ATOMS 2- ATOMS WITH SEVERAL OPTICALLY ACTIVE ELECTRONS 3- LS COUPLING 4- ENERGY LEVELS OF THE CARBON ATOM 5- THE ZEEMAN EFFECT

5 - chapter 5: MOLECULES 1- IONIC BONDS , COVALENT BONDS 2- MOLECULAR SPECTRA 3- ROTATIONAL SPECTRA 4- VIBRATION-ROTATION SPECTRA 5- ELECTRONIC SPECTRA 6- THE RAMAN EFFECT

Teaching and Learning Methods

1 - The course is given as: 1.Lectures.2- Class tutorials. 3- Power point -

2 - - Several problems on the material are solve at the end of each unit -

3 - - In addition some assignments are given to the students as a homework

Students Assessment

Assessment Method	TIME	MARKS
First Hour Exam	at the end of chapter 2	20%
Second Hour Exam	at the end of chapter 4	20%
homework and assignment	after each chapter	10%

Books and References

Essential books	Robert Eisberg, Robert Resnick, Quantum_Physics of Atoms-Molecules-Solids-Nuclei-Particles)