Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Atomic and Molecular Physics	PHYS620	3	-	3	9	1st/ 2nd	2nd/ 3rd	-

Student's workload			
In-class activities	Contact Hours	Self-learning/study	Hours
Lectures	45	Preparation for classes	129
Laboratory	-	Case studies	-
Exams and quizzes	5	Working on lab experiment	-
Lab demo	-	HW/Assignments	26
		Study for exam	36
Total	50	Total	191
Total Learning Hours = 241		Equivalent ECTS points = Total LH/28 = 9	

BRIEF COURSE DESCRIPTION

- This course is designed to provide full understanding of macroscopic properties of matter based on its microscopic composition of the constituent atoms. The course includes: The hydrogen like atoms, atoms with more than one electron, emission and absorption of electromagnetic radiation by atoms, and modern developments in atomic and molecular Physics.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Review the hydrogen atom and atoms with more than one electron system.
2. Provide the basics of emission and absorption of radiation by atoms.
3. Provide the basics of emission and absorption of radiation by atoms.
4. Explain electronic states and spectra of polyatomic molecules.
5. Explore different experimental techniques in atomic and molecular physics.
6. Discuss a brief account on modern developments in atomic and molecular physics.

COURSE CONTENTS

- Review of hydrogen atom.
- Atoms with more than one electron: Helium atom, principle of the electron shell for larger atoms, alkali atoms, excited atomic states, exotic atoms, emission and absorption of radiation by atoms.
- Diatomic molecules: H2 Molecule, Electronic states, Molecular binding, Rotation and vibration states.
- Polyatomic molecules: Electronic states, rotation and vibrations, spectra, Clusters and chemical reactions, Molecular dynamics and wave packets.
- Experimental techniques in atomic and molecular physics: Microwave spectroscopy, Infrared spectroscopy, Raman spectroscopy, Spectroscopy with synchrotron radiation, Electron spectroscopy, Modern developments in atomic and molecular physics.

ASSESSMENT CRITERIA

- Mid-Term exam and Quizzes: 30 %
- Assignments and classroom activities: 20 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, blackboard and visualization, brainstorming, group and interactive discussion, Interactive illustration – Problem based learning

TEXT BOOK

- Wolfgang Demtröder, Atoms, Molecules and Photons, 2nd edition, (Springer, 2010).

REFERENCE BOOKS

- H. Haken and H.C.Wolf, The Physics of Atoms and Quanta, (Springer,2005).
- B. Bransden and C. Joachain, Physics of Atoms and Molecules, (Longman Scientific and Technical 1990).