Advanced Atomic and Molecular Physics

Academic Year: (2022 / 2023) **Review date: 14-06-2022**

Department assigned to the subject: Physics Department

Coordinating teacher: SANCHEZ FERNANDEZ, LUIS RAUL

Type: Electives ECTS Credits : 6.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Basic quantum mechanics and techniques, including the treatment of angular momentum, perturbation theory, solution for the Schrodinger equation in one dimension, and the Hydrogen atom.

OBJECTIVES

The course provides the basis for an understanding of atomic and molecular structure and spectroscopy. The basic computational procedures in this field are introduced in some detail. The student is introduced to the use and interpretation of spectroscopic data on atoms and diatomic molecules.

The course provides the student with an appropiate training in atomic and molecular physics, as well as in the use of atomic and molecular data for applications such as spectroscopy or plasma diagnostics.

DESCRIPTION OF CONTENTS: PROGRAMME

Poli-electronic atoms; atomic structure; central field approximation and main corrections; computational techniques; interactions with external static fields; atomic spectroscopy. Born-Oppenheimer approximation for molecules; molecular bonding and stability; electronic, vibrational and rotational wavefunctions; molecular spectroscopy for diatomics; basics on polyatomic molecules; applications.

LEARNING ACTIVITIES AND METHODOLOGY

* Teaching methods:

Classroom lectures. Classroom problem solving sessions. Visits to the spectroscopy laboratory. Homework assignments including computer tasks.

* Course material:

Lecture notes. Virtual facilities (a dedicated web page) will be also provided with the aim of improving the interaction with the lecturers and the
learning of the subject.

ASSESSMENT SYSTEM

Evaluation shall take into account attendance and class participation, including practical classes and solution of questionnaries proposed along the course (30% of the final mark). A written exam will take place at the end of the semester (70% of the final mark).

% end-of-term-examination:	70
% of continuous assessment (assigments, laboratory, practicals…):	30

BASIC BIBLIOGRAPHY

- Atkins, P.W. Molecular Quantum Mechanics, Oxford Univ. Press, 1989
- B.H.Bransden, C.J.Joachain Physics of atoms and molecules, Longman, 1994
- I.I.Sobelman Atomic Spectra and Radiative Transitions, Springer Verlag.

ADDITIONAL BIBLIOGRAPHY

- G.K.Woodgate Elementary atomic structure, McGraw Hill.

- Haken Wolf Molecular Physics and elements of Quantum Chemistry, introduction to experiments and theory, Springer Verlag , 1995