Course plan

Subject	**Quantum Physics**		
Matter	Physics		
Degree	Physics		
Study program	469	**Reference no.**	45759
Term	Second term	**Type**	Compulsory
Level	Bachelor degree	**Course/Year**	Third year, 2019-2020
ECTS units	6 ECTS in the second term (plus 6 ECTS in the first term)		
Language	English		
Lecturer in charge	David José González Fernández		
Contact details (E-mail, telephone …)	Email: david@liq1.fam.cie.uva.es Phone: 983 42 3891 Office: B114		
Office hours	Please check the timetable		
Department	Física Teórica, Atómica y Óptica		

1. Placement of the subject in the study program

1.1 Context

The main aim of Quantum Physics is to provide the conceptual tools needed for the analysis and solution of a wide range physical problems at the microscopic level.

1.2 Relationship with other subjects

Quantum Physics is a basic cornerstone of Modern Physics as it constitutes a basic ingredient of topics such as Atomic Physics, Nuclear Physics or Solid State Physics.

1.3 Requirements

- A good command of algebra and vector analysis
- Knowledge of the theory of complex variables
- Some elementary knowledge of functional analysis and differential equations
- Some elementary knowledge of probability and random variables.

2. Competencies and capabilities

2.1 General

T1: Analysis and synthesis skills
T2: Planning and organization skills
T3: Oral and written communication skills
T4: Problem solving skills
T5: Working skills
T7: Individual working an learning skills
T8: Ability to get adapted to new situations
T9: Creativity.

2.2 Specific

E2: The student should be able of performing presentations of academic topics to specialized and general public
E4: The student should be able to introduce him/herself to new fields of knowledge.
E6: The student should be able to make the needed simplifications and assumptions to reduce a given problem into a much simpler one.
E7: The student should be able to develop his/her own software and use standard computing software.
E8: The student should be able to search and use bibliography in Physics and other technical areas, as well as use other information resources to deliver papers and other projects.
E9: The student should be able to explain certain concepts
E10: The student should able to be updated about new developments.
E13: The student should be able to use knowledge from other areas of Physics to solve a given problem.
E15: The student should be able to understand the most common mathematical and numerical methods used in Physics

3. Aims

- Understand the experimental basis of Quantum Physics
- Familiarize with the particle-wave aspect of the microscopic phenomena
- Understand the concept of wave-function and its use in the interpretation of the quantum phenomena
- Solve Schrödinger's equation for the specific case of some simple one-dimensional potentials.
- Understand and learn how to apply the postulates of Quantum Mechanics.
- Analyze the experiments leading to the introduction of the spin.
- Familiarize with the formalism of the kinetic moments.
- Understand the behavior of identical particles. Application of Pauli's principle to explain the Periodic Table.

4. Contents

1. The Mathematical Tools of Quantum Mechanics
2. The Postulates of Quantum Mechanics
3. General Properties of Angular Momentum in Quantum Mechanics
4. Addition of Angular Momenta
5. Systems of Identical Particles
6. Multielectron Atoms: Ground States and Optical Excitations
7. Molecules
8. Solids: Conductors and Semiconductors

5. Time distribution for the Lectures

IN-CLASS ACTIVITIES	HOURS	OUT-OF-CLASS ACTIVITIES	HOURS
Theory	40	Individual work	60
Practical lectures	20	Group work	30
In-class total time	**60**	**Out-of-class total time**	**90**

6. Methodology

The teaching process will include several academic activities such as: lectures, problem solving, seminars and exams.
The lectures will consist on the exposition and explanation of the topics listed in the program.
The problem solving part will focus on the application of the theoretical concepts introduced in the lectures.
Seminars. The research work performed by most members of our Department deals with topics closely connected with Quantum Physics. Therefore, some of the seminars organized by our Department can be of interest to the students and we will encourage them to attend those seminars.

7. References

- Quantum Physics. R. Eisberg and R. Resnick, 2nd Ed. John Wiley and Sons.
- Quantum Mechanics. Vol I and II. C. Cohen-Tannoudji, B. Diu and F. Laloe, John Wiley and Sons.
- An introduction to Quantum Physics, A.P. French and E.F. Taylor, Ed. Reverte.

8. Overview of the marking system

Procedure	Weight over the final mark	REMARKS
Problem solving / mid term test	20%	Mandatory
Final exam	80%	Mandatory

8. Final remarks