

Academic Year: ( 2022 / 2023 )

Review date: 20-06-2022

Department assigned to the subject: Department of Physics

Coordinating teacher: IÑARREA LAS HERAS, JESUS

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 1

**REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)**

Mathematics, basic Quantum Mechanics

**DESCRIPTION OF CONTENTS: PROGRAMME**

1. Postulates of Quantum Mechanics. Dirac's matrix formulation. Observables and operators. Eigenvalues and eigenvectors. Discrete and continuous basis. Spectral decomposition. Temporal evolution of quantum systems. Density matrix.
2. Theory of angular momentum. Orbital angular momentum. Electron spin. Spin-orbit interaction. Stern-Gerlach experiment. Zeeman effect.
3. Approximation methods in Quantum Mechanics: perturbative and variational methods.
4. Introduction to light-matter interaction.
5. Multi-electronic atoms. Pauli's exclusion principle. Hartree's theory and the periodic table.
6. Introduction to Molecular Physics. Born-Oppenheimer model.

**LEARNING ACTIVITIES AND METHODOLOGY**

- AF1. THEORETICAL-PRACTICAL CLASSES. Knowledge and concepts students must acquire. Receive course notes and will have basic reference texts. Students partake in exercises to resolve practical problems
- AF2. TUTORING SESSIONS. Individualized attendance (individual tutoring) or in-group (group tutoring) for students with a teacher. Subjects with 6 credits have 4 hours of tutoring/ 100% on-site attendance.
- AF3. STUDENT INDIVIDUAL WORK OR GROUP WORK. Subjects with 6 credits have 98 hours/0% on-site.
- AF8. WORKSHOPS AND LABORATORY SESSIONS. Subjects with 3 credits have 4 hours with 100% on-site instruction. Subjects with 6 credits have 8 hours/100% on-site instruction.
- AF9. FINAL EXAM. Global assessment of knowledge, skills and capacities acquired throughout the course. It entails 4 hours/100% on-site
- AF8. WORKSHOPS AND LABORATORY SESSIONS. Subjects with 3 credits have 4 hours with 100% on-site instruction. Subjects with 6 credits have 8 hours/100% on-site instruction.
- MD1. THEORY CLASS. Classroom presentations by the teacher with IT and audiovisual support in which the subject's main concepts are developed, while providing material and bibliography to complement student learning
- MD2. PRACTICAL CLASS. Resolution of practical cases and problem, posed by the teacher, and carried out individually or in a group
- MD3. TUTORING SESSIONS. Individualized attendance (individual tutoring sessions) or in-group (group tutoring sessions) for students with teacher as tutor. Subjects with 6 credits have 4 hours of tutoring/100% on-site.
- MD6. LABORATORY PRACTICAL SESSIONS. Applied/experimental learning/teaching in workshops and laboratories under the tutor's supervision.

**ASSESSMENT SYSTEM**

- \* Laboratory sessions (15% of final mark)

Attendance to the laboratory sessions is compulsory. The students must also write a report on each of the experiments carried out in every session. The mark will be common for all the members of each group.

- \* Activities in groups (25% of final mark)

The evaluation will take into account attendance and student attitude, short test exams periodically proposed, as well as the student performance in the proposed activities.

\* Written exam (60% of final mark)

The exam will take place at the end of the semester and it will be common for all the students.  
Contents:

- Problems to be solved covering the main topics of the program.
- Short theoretical questions.

A minimum score of 3 over 10 will be required to pass the course.

<b>% end-of-term-examination:</b>	60
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	40

#### BASIC BIBLIOGRAPHY

- Claude Cohen-Tannoudji, Bernard Diu, and Franck Laloë Quantum Mechanics, Ed. Wiley-Vch.
- David Ferry. Quantum Mechanics. An Introduction for Device Physicists and Electrical Engineers. Third Edition. , CRC press 2001, 2001
- David Ferry. Quantum Mechanics. An Introduction for Device Physicists and Electrical Engineers. Third Edition. , CRC press 2001, 2001
- Nouredine Zettili. Quantum Mechanics: Concepts and Applications. , Ed. Wiley.
- Nouredine Zettili. Quantum Mechanics: Concepts and Applications. , Ed. Wiley.

#### ADDITIONAL BIBLIOGRAPHY

- David A. B. Miller.. Quantum Mechanics for Scientists and Engineers, Ed. Cambridge University Press..