Quantum Physics

Academic Year: (2022 / 2023) **Review date: 20-06-2022**

Department assigned to the subject: Department of Physics

Coordinating teacher: SANCHEZ FERNANDEZ, LUIS RAUL

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

It is highly recommended that students have successfully passed the following first-year subjects:

Physics I, Physics II, Calculus I, Calculus II, Algebra & Programming.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Foundation of Quantum Mechanics. Black body spectrum and Planck¿s postulate. Einstein¿s theory of the photoelectric effect. The Compton effect. De Broglie
principle and the wave-particle duality. Rutherford and Bohr atomic models.
2. Schrödinger¿s equation. Wave functions. Born interpretation: probability density. Expected values and measurement. Energy, position and momentum. Uncertainty
principle.
3. Time-independent Schrödinger equation. Energy quantization. Bounded and unbounded states.
4. Unidimensional problems. Free particle solution. Potential steps, wells and barriers. The harmonic oscillator. Quantum tunnelling.
5. Three-dimensional problems. Central potentials. The Schrödinger equation in spherical coordinates.
6. Solution of the Hydrogen atom.

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

1) Laboratory sessions (20% of final mark)
Attendance to the laboratory sessions is compulsory to pass this course.
The mark of the reports takes into account attendance, quality of reports, etc. The mark is usually shared by the members of the lab group, except when explicitly stated.

2) Assessment during the course (20% of final mark)

- Midterm exams

3) Final exam (60% of final mark)
The exam is made at the end of the semester and it is the same for all the students
Contents:
- Problems to be solved covering the topics of the program

The minimum required grade in the final exam is 3/10.

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- D.J. Griffiths Introduction to Quantum Mechanics. , Ed. Prentice Hall., 1995

ADDITIONAL BIBLIOGRAPHY

- Anthony Levi Applied Quantum Mechanics for Engineers and Physicists, Cambridge University Press, 2006

- David Miller Quantum Mechanics for Scientists and Engineers, Cambridge University Press, 2007