SUBJECT TEACHING GUIDE

G65 - Physics Laboratory IV

Double Degree in Physics and Mathematics
Degree in Physics

Academic year 2022-2023

1. IDENTIFYING DATA					
Degree	Double Degree in Physics and Mathematics Degree in Physics			Type and Year	Compulsory. Year 4 Compulsory. Year 3
Faculty	Faculty of Sciences				
Discipline	Subject Area: Physics Laboratories Central Module				
Course unit title and code	G65 - Physics Laboratory IV				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Web	http://moodle.unican.es/				
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. CIENCIAS DE LA TIERRA Y FISICA DE LA MATERIA CONDENSADA
Name of lecturer	FERNANDO RODRIGUEZ GONZALEZ
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Office	Facultad de Ciencias. Planta: + 2. DESPACHO PROFESORES (2008)
Other lecturers	LUIS JULIAN GOICOECHEA SANTAMARIA JESUS MARIA RODRIGUEZ FERNANDEZ IGNACIO HERNANDEZ CAMPO FERNANDO AGUADO MENENDEZ JAVIER ANDRES BROCHERO CIFUENTES PABLO MATORRAS CUEVAS

3.1 LEARNING OUTCOMES
- To get a background of knowledge about basic theory, instrumentation and physical phenomena of interest in Quantum Physics and Structure of Matter.
- Design and development of a measurement protocol and its process.
- Automatization of the measurement process regarding its control and manipulation from an automatized environment.
- To know methods of searching for scientific documents (papers, books, Thesis, etc.) containing information about background and related experiments to the experimental process under design.
- Validation of the developed measurement methods by means of other alternative measurement methods.
- Training for experimental techniques of interest in research laboratories and industry.
- Basic experiments on Quantum phenomena: photoelectric effect, harmonic oscillator, atomic levels, nuclear levels, etc.
- Experiments on materials characterization and measurements of physical properties: crystal structure; correlations between structure and physical properties; mechanical, optical, electric and magnetic properties of materials; superconductivity, etc.
- Use of advance instrumentation: x-ray diffractometer, optical polarizing microscopes, spectrometers, amplifiers, particle detectors, etc.
- Simple experimental setups involving different instruments: particle attenuation, electronic circuits, electrical resistivity, etc.
- To know the fundamental role of Physics in different high-level topics related to the scientific-technological knowledge.
- To complement the vision of the Degree students about Physics, providing them a general overview of its frontiers.
- To underline the multidisciplinary character of science and technology in the XXI century and how Physics contributes to this this new scientific scenario from both basic and applied perspectives.
- To be able to design a scientific and technological project proposal and to analyze its feasibility.
- To be able to elaborate and present the results of a project in a realistic and positive way.
- To evaluate the strengths and weaknesses of an active project, and to define targets for project improving on the basis of the evaluation.

4. OBJECTIVES
To know and do experiments on relevant phenomena related to Quantum Physics and Structure of Matter.
To know and apply the scientific method: experimental rigor, critical observation, analysis of results and ability to propose models.
To design new methods to investigate behaviors of physical systems on the basis of the knowledge of laws governing such behaviors using instrumentation available in the laboratory.
To integrate instruments around a coordinated measurement environment.
To study technical booklets of a complex instrument and apply it to get new measurements.
To be able to accommodate to a new measurement environment, being able to describe its basis, precedents, development and final validation.
To get a wide background of knowledge and handling different experimental techniques and instrumentation of common use in research laboratories and industry.
The objectives and experimental techniques used along the course are detailed in the course program.

6. COURSE ORGANIZATION

	CONTENTS
1	Block 1 Program of practical works of Quantum Physics: P1. Planck constant. Photoelectric effect. P2. Frank-Hertz experiment. Discrete energy levels in atoms. P3. Nuclear Magnetic Resonance. P4. Disintegration law of nuclear specimen. P5. Beta disintegration and Beta radiation-matter interaction. P6. Nuclear structure and Gamma radiation: Photoelectric and Compton effects, and positron annihilation. P7. Rutherford experiment. Dispersion of Alpha particles by matter. P8. Zeeman effect. Atomic transitions under magnetic field. P9. Balmer series. Visible spectrum of Hydrogen. P10. Electron diffraction. L. de Broglie hypothesis
2	Block 2 Program of practical works of Structure of Matter: P1.1. Structure of Matter: X-ray diffraction experiments. P1.2. Analysis and simulation of x-ray diffractograms and compound identification. P2.1. Optical polarizing microscope. Light transmission in isotropic and anisotropic media. P2.2. Structural correlations: Refractive index and symmetry in crystal and amorphous systems. P3. Band structure in semiconductors. Relationship between light emission and electrical polarization in LEDs. P4. Electrical conductivity in metals. P5. Vibrations in solids and liquids. Raman effect.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Practical works in laboratory	Laboratory evaluation	Yes	No	20,00
Four 8-page reports of selected practical works, and six result sheets (2 pages each) for the remainder six experiments.	Work	Yes	No	50,00
Exam There will be a written exam at the end of semester about the practical works done during the course.	Written exam	Yes	Yes	30,00
TOTAL				100,00

Observations

Due to its experimental character, there is only one evaluation for practical works and corresponding reports/result sheets. The evaluation of the practical works consists of two parts: evaluation of the attitude and performance of the student in the laboratory (2/10), and evaluation of the reports (5/10). Each student will present a total of four reports (two for Quantum Physics and two for Structure of Matter) plus result sheets for the remainder six experiments along the semester. Each report will describe the experimental work of selected practical works and will be presented within two weeks after finishing the reported practical works. Result sheets must be presented within 24 hrs. after the end of the corresponding experiment. The final evaluation will be a weighted average between the practical work grade (70%) and the grade obtained in the final exam at the end of the semester (30%). The course will be passed with a grade equal or greater than 5 out of 10.

Observations for part-time students

Due to its experimental character, part-time students must follow the full program of the course. Professors will try to make the realization of practical works easy within the assigned schedule.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

El documento básico de trabajo ha sido realizado por los profesores de la asignatura y se encuentra en como documento pdf en la asignatura Laboratorio de Física IV del Aula Virtual (Moodle).