SUBJECT TEACHING GUIDE

G70 - Physics of Materials

Double Degree in Physics and Mathematics
Degree in Physics

Academic year 2018-2019

1. IDENTIFYING DATA					
Degree	Double Degree in Physics and Mathematics Degree in Physics			Type and Year	Optional. Year 5 Optional. Year 4
Faculty	Faculty of Sciences				
Discipline	Subject Area: Physics of Materials Mention in Fundamental Physics				
Course unit title and code	G70 - Physics of Materials				
Number of ECTS credits allocated	6	Term		Semester based (1)	
Web					
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	JESUS MARIA RODRIGUEZ FERNANDEZ LUIS FERNANDEZ BARQUIN FERNANDO AGUADO MENENDEZ

3.1 LEARNING OUTCOMES
- Knowledge and use of basic models and theories for describing the physical properties of materials.
- Skill development to setup experiments for measuring physical properties of materials.
- Employ of basic instrumental devices of interest in materials science.
- Classification and characterization of materials according to their structure.

4. OBJECTIVES
Being able to classify materials according to their structure and physical properties.
To know physical models enabling to understand a wide variety of materials properties.
To measure physical properties in different types of materials.
To gain an ample background of knowledge and skillness in different experimental techniques and apparatuses of common use in research laboratory and industry.
To study technical reports about a complex instrument, being able to apply it to new measurements.

6. COURSE ORGANIZATION	
CONTENTS	
1	Topic 1 Introduction. Types and classification of materials. Relationship between structure and physical properties.
2	Topic 2 Dielectric and Optical Properties of materials. Insulators and Semiconductors. Complex refractive index. Absorption and Reflection of light by Materials. Absorption and luminescence processes in solids. Configurational coordinate energy diagrams. Relevant Optical and Diectectric phenomena.
3	Topic 3 Electrical properties of materials. Insulators, Metals and Semiconductors. Band structure and conductivity.
4	Topic 4 Magnetic properties of materials. Magnetic phenomena: microscopic description. Diamagnetism, Paramagnetism and Ferromagnetism. Other magnetic structures: structural characterization.
5	Topic 5 Superconductivity. Experimental phenomena and characterization of superconductors. BCS theory. Predictions and new superconductor materials.
6	Topic 6 Functional and nanostructured materials. Structure and physical properties. Applications. Multifunctional materials. Interplay between properties and types of materials. Nanometric sized materials. Size effects and quantum confinement. Influence on physical properties.
7	Topic 7 Laboratory works: Microscopic techniques for materials analysis and characterization Optical absorption spectroscopy: electronic structure of insulators and semiconductors. Emission/excitation spectroscopy: Photoluminescent materials.
8	Topic 8 Laboratory works: Macroscopic techniques for analysis and characterization of materials. Electrical resistivity in metals. Thermal effects. Characterization of Ferromagnetic materials: Hysteresis loops in soft and hard ferro/ferrimagnetic materials.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Reports on practical works	Work	No	No	50,00
Final written exam	Written exam	Yes	Yes	0,00
Control exam of topics 1-2	Written exam	No	Yes	15,00
Control exam of topics 3-4	Written exam	No	Yes	20,00
Control exam of topics 5-6	Written exam	No	Yes	15,00
TOTAL				100,00

Observations

The student must write three reports on the laboratory works. The evaluation of each laboratory work will consist of 1) the report (80%) and 2) laboratory work (20%). The latter evaluation consists of a personal and continuous tracking about queries and attitude of the student in the laboratory (1 hr/lab work).
The three controls consist of test exams (one hour each) and the final exam will last two hours.
The final mark of the course will be the average of marks obtained from laboratory works and exams.

Observations for part-time students

Professors will try to make easy part-time students to follow the course program.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

Temas 1-8
R. J. Naumann, Introduction to the Physics and Chemistry of Materials, CRC Press, Boca raton (2009).

Temas 1,2,3,6,7
M. Fox, Optical Properties of Solids, Oxford University Press, Oxford (2001).

Temas 1,3-6,8
K. H. J. Buschow and F. R. De Boer, Physics of Magnetism and Magnetic Materials, Kluwer (2003).