

SUBJECT TEACHING GUIDE

G52 - Electromagnetism and Optics

Double Degree in Physics and Mathematics

Degree in Physics

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Double Degree in Physics and Mathematics Degree in Physics			Type and Year	Compulsory. Year 3 Compulsory. Year 3
Faculty	Faculty of Sciences				
Discipline	Subject Area: Electromagnetism and Optics Central Module				
Course unit title and code	G52 - Electromagnetism and Optics				
Number of ECTS credits allocated	6	Term	Semester based (1)		
Web	https://grupos.unican.es/optica/index.html				
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. FISICA APLICADA				
Name of lecturer	FERNANDO MORENO GRACIA				
E-mail	fernando.moreno@unican.es				
Office	Facultad de Ciencias. Planta: + 3. DESPACHO PROFESORES (3044)				
Other lecturers	FRANCISCO GONZALEZ FERNANDEZ				

3.1 LEARNING OUTCOMES

- The subject in question is eminently theoretical and on completion, the student will be able to:
 - Appreciate Physics as a way of understanding Nature.
 - Discuss and be able to understand the interpretation of relevant physical phenomena in the areas of mechanics, geometrical optics, waves, structure of matter, electricity and electronics by means of the corresponding basic models.
 - Identify the key points of a physical phenomenon and how to analyse them experimentally taking into account the proposed model and the necessary mathematical methods.
 - Understand the approach to experimental demonstrations, both the physical phenomena involved and the usefulness of the instrumentation used.
 - Carry out simple experiments to analyse basic phenomena in the different areas of physics .
 - Analyse the results obtained, taking into account the precision of the instruments used.

4. OBJECTIVES

The subject aims to introduce students to the basics of electromagnetic theory: To understand and theoretically handle the concept of wave and its electromagnetic behavior (intensity and polarization), how it propagates across different media and how it interacts with the, and to understand basic phenomena appearing due to the wave nature of the electromagnetic radiation: interference and diffraction.

Finally, it is aimed to learn to solve simple problems of basic electromagnetic theory.

6. SUBJECT PROGRAM	
CONTENTS	
1	1.-WAVES. ELECTROMAGNETIC THEORY 1.1.-FUNDAMENTALS OF WAVES 1.2.-ELECTROMAGNETIC THEORY 1.3.-FOURIER THEORY
2	2.-POLARIZATION OF ELECTROMAGNETIC WAVES (EWs). PROPAGATION IN ISOTROPIC MEDIA 2.1.-FUNDAMENTALS OF POLARIZATION OF EWs 2.2.-PROPAGATION IN ISOTROPIC MEDIA. FRESNEL LAWS 2.3.-CONFINED WAVES. GUIDING OF EWs. OPTICAL FIBERS
3	3.-DISPERSION AND ABSORPTION IN DIELECTRIC, ISOTROPIC AND LINEAR MEDIA 3.1.-DIPOLE RADIATION EMISSION. ANTENNAS. 3.2.-MODELS OF RADIATION-MATTER INTERACTION. RESONANCES 3.3.-DIELECTRIC AND METALLIC MEDIA. 3.4.-ENGINEERIZED MATERIALS: METAMATERIALS.
4	4.-PROPAGATION IN ANISOTROPIC MEDIA 4.1.-PROPAGATION OF EWs 4.2.-REFRACTION AND REFLECTION OF EWs 4.3.-NATURAL AND ARTIFICIAL ANISOTROPIES 4.4.-PRODUCTION AND ANALYSIS OF POLARIZED EWs. APPLICATIONS IN THE VISIBLE RANGE
5	5.-INTERFERENCES 5.1.-FUNDAMENTALS 5.2.-INTERFERENCES WITH TWO BEAMS. APPLICATIONS 5.3.-INTERFERENCES WITH MULTIPLE WAVES. APPLICATIONS 5.4.-COHERENCE
6	6. DIFFRACTION. SCALAR THEORY 6.1.-DIFFRACTION SCALAR THEORY 6.2.-FRAUNHOFER AND FRESNEL DIFFRACTION 6.3.-EXAMPLES: SQUARE AND CIRCULAR APERTURES 6.4.-DIFFRACTION GRATINGS

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
Practical exercises and their subsequent presentation. The student will be allowed to use theoretical text books as support.	Work	No	Yes	20,00
Partial Exam: Examination of the first part of the subject: Blocks 1, 2 and 3. It has eliminatory character of this part. The student will be allowed to use theoretical text books as support.	Written exam	No	Yes	30,00
Theoretical part (40%) and a practical part (60%). This will be Partial for those who have passed the first partial and complete for those who have not passed it. For the latter, it is 60% of the final grade and will require a minimum grade of 4.5. The st	Written exam	Yes	Yes	30,00
There will be 2 Tests distributed properly throughout the course. One before the Partial Exam of Blocks 1, 2 and 3 and another after the Partial Exam of Blocks 4, 5 and 6	Written exam	No	Yes	20,00
TOTAL				100,00
Observations				
An extraordinary examination will be offered that will be worth 90% of the qualification. The remaining 10 % corresponds to the performance of practical exercises and their subsequent presentation. The student will be allowed to use theoretical text books as support.				
Observations for part-time students				
The part-time student must inform the person responsible for the course at the beginning of the term to fix the evaluation details.				

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

- J. Casas, "Óptica", Librería Pons. Zaragoza (1994).
- E. Hecht "Óptica", 3ª Edición. Adison-Wesley Iberoamericana. Madrid (2000).
- B.E.A. Saleh y M.C. Teich "Fundamentals of Photonics", John Wiley & sons. New York (1991).