

SUBJECT TEACHING GUIDE

G52 - Electromagnetism and Optics

Double Degree in Physics and Mathematics Degree in Physics

Academic year 2021-2022

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					
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 matter is eminently theoretical and upon completion, the student:
 - will understand the concept of the wave, its properties and its propagation within the Electromagnetic Theory.
 - will understand the concept of polarization and will know how to handle it within the wave propagation in isotropic media.
 - will have acquired the basics of physics of radiation-matter interaction through classical models.
 - will understand the propagation of electromagnetic waves in media whose optical properties depend on the direction of propagation.
 - will have acquired the basics on interference and diffraction of electromagnetic waves.
 - will be able to solve simple problems with mathematical tools introduced in the development of electromagnetic theory.
 - will have the basic tools to address more complex problems of Electromagnetic Radiation Theory.

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. COURSE ORGANIZATION

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	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.	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 to be a	Written exam	Yes	Yes	30,00
There will be 2 Tests distributed properly throughout the course. One before the Partial Exam of Blocks 1 and 2, and another after the Partial Exam of Blocks 3 and 4	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 a work.				
Observations for part-time students				
The part-time student must inform the person responsible for the course at the beginning of the term.				

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).