GUIDE OF THE COURSE

PHOTONICS. OPTICAL INSTRUMENTATION AND APPLICATIONS.

Course 2019-2020
(Updated: 08/05/2019)

MODULE	TOPIC	COURSE	SEMESTER	ECTS	CHARACTER
Nanotechnology: Physics and applications	Photonics. Optical instrumentation and applications	1º	1º	6	Optional

LECTURERS	CONTACT
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	TUTORING SCHEDULE
	http://optica.ugr.es/static/InformacionAcademicaDepartamentos/*/docentes
MASTER	
Master in Physics: Radiations, Nanotechnology, Particles and Astrophysics.	

REQUISITES AND/OR RECOMMENDATIONS
Students should have knowledge of electromagnetism, optics and electro-optics effects.
BRIEF DESCRIPTION OF CONTENTS
Introduction. Classification and function of Optical Instruments; fundamental characteristics of the Optical Instruments; instruments for near vision: simple and compound microscopes. Applications. Instruments for far vision: telescopes. Applications. Photo and video recorder, optical projectors. Optoelectronic instrumentations: intensifiers, converters, etc. Characteristics of optical sensors. Components. Types of sensors. Modulation sensors. Design. Plasmonic sensors. Nano-optics. Nanophotonic devices.

GENERAL & SPECIFIC SKILLS

GENERAL SKILLS

- CG3-Capacity for teamwork. The student must integrate their work in the interest of a common project.
- CG4-Ability to express and defend in public the results and conclusions obtained as a result of the learning process. It shall develop and master the techniques of oral communication with any audience. Learn to use their personal potential to present results publicly.
- CG5-Capacity to generate innovative and competitive proposals for research and professional activity.
- CB6–To acquire knowledge and understanding that provide a basis or opportunity for originality in developing and/or applying ideas, often in a research context.
- CB7-That the students can apply their knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
- CB8-Those students are able to integrate knowledge and handle complexity, and formulate judgments based on information that was incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments.
- CB9–That students are able to communicate their knowledge and conclusions with arguments underpinning them to specialists and non-specialists in a clear and unambiguous manner.
- CB10–Those students acquire the learning skills that enable them to continue studying in a way that will be largely self-directed or autonomous.

TRANSVERSAL

- CT2-Ethical commitment. Both as a student and later in their professional work, the student should be aware of the absolute need to perform their tasks with absolute respect for honesty, truth and service to society.
- CT1-Critical thinking skills: the student must be able to distinguish those aspects of their work or other involving innovation and advancement.
- CT3-Ability to self-motivation. As a part of maturity to be attained in the training process at these levels: the difficulties have to confront with determination and confidence.
- CT4-Ability for recognition of diversity and multiculturalism. It is part of the vital attitude that is supposed to graduate. His social conscience must guide those aspects of their profession involving other community members.

SPECIFIC

- CE1-Ability to interpret data from the experimental observation and numerical simulation.
- CE2-Ability to rigorously consider the limitations and uncertainties in the results and the methods that can be applied in order to minimize them.
- CE3-Ability to drill in various fields of physics and identify areas that are at the limits of knowledge.
- CE4-Ability to formulate hypotheses, designing experiments, handling calculation methods and numerical simulation and developing models.

OBJETIVES

The student will know/understand/be able to:

- The more relevant aspects of the optical instrumentations, sensors, transducers, etc. and the application to Research.
- The essential fundamentals of these devices.
- The types of sensors, measurers, transducers, etc.
- Measurement process related to the optical properties of the device.
- Use different optical devices depending on the being carried out at all times.

- Select, within each type of device, the most appropriate to each specific task.
- Assess the quality of each sensor.
- The fundamentals of the Nano-Optics and the fundamentals of the nanophotonics devices.

CONTENTS OF THE COURSE

LECTURES:

Lesson 1.- Introduction. Classification and utilities of the optical instruments.
Lesson 2.- Essential characteristics of the optical instrumentations.
Lesson 3.- Instruments for near vision: simple and compound microscopes. Applications.
Lesson 4.- Instruments for far vision: telescopes. Applications.
Lesson 5.- Photo and video recorder, optical projectors. Applications.
Lesson 6.- Optoelectronic instrumentations: intensifiers, converters, .. .
Lesson 7.- Characteristics of optical sensors. Components.
Lesson 8.- Types of sensors.
Lesson 9.- Modulation sensors. Design.
Lesson 10.- Plasmonic sensors.
Lesson 11.- Nano-optics.
Lesson 12.- Nanophotonic devices.

LABORATORY CLASSES

Practical lesson.- 1. Optical characterization of displays.
Practical lesson 2.- Image-quality evaluation of devices based on detector arrays by speckle techniques.

REFERENCES

- OPTOELECTRONICS, AN INTRODUCTION, J, Wilson and J. F. B. Haws. Prentice Hall, 1989.
- PRINCIPLES OF MODERN OPTICAL SYSTEMS, Ivan Andonovic and Deepak Uttamchandani. Artech House Inc, 1998.
- FIBER OPTICS SENSOR, AN INTRODUCTION FOR ENGINEERS AN SCIENTISTS, Eric Udd. John Wiley & Sons Inc. New York, 1991.
- PRINCIPLES OF NANO-OPTICS, L. Novotny, B. Hecht, Editorial: Cambridge University Press, 2006
- INTRODUCTION TO NANOPHOTONICS, S. V. Gaponenko, Editorial: Cambridge University Press, 2010
- Currents papers in Journal of the Optical Society of America A, Optics Express, Optics Letters, etc.

ENLACES RECOMENDADOS

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ww.opticexpress.org
http://spie.org/
https://www.elsevier.com/about/open-science/open-access/open-access-journals

METHODOLOGY

Lectures: To transfer the contents of the subject, motivating the students to reflection, facilitating the discovery of relationships between different concepts and forming him a critical mindset.
Workshops: To develop in the students the cognitive and procedural skills of matter.
Academic tutoring: To guide the autonomous and group work of students, focusing on different aspects of the subject and guide the comprehensive academic training of the student.

Study and independent work of students: To foster in the student the ability to self-regulate their learning, by planning, designing it, evaluating it and adapting it to their particular conditions and interests. **Teamwork**: To encourage students in the generation and exchange of ideas, identification and analysis of different views on a topic, generalization or transfer of knowledge and critical assessment of it.
EVALUATION SYSTEM
1. Final (or partial) exams and evaluation of the results of the activities proposed by the teacher Minimum weight: 20 - Maximum weight: 50 2. Seminars. Oral presentation of work developed independently Minimum weight: 15 - Maximum weight: 40 4.- Laboratory. Attendance of all lab sessions and elaboration of lab reports is compulsory. Weight: 20 To pass this course is necessary to pass each one of the points 1, 2 and 4 independently.
ADITIONAL INFORMATION