



IDENTIFYING DATA

Laser Physics

Subject	Laser Physics			
Code	001M117V01103			
Study programme	(*)Máster Universitario en Fotónica e Tecnoloxías do Láser			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	1st	1st
Teaching language				
Department				
Coordinator	Paredes Galán, Ángel			
Lecturers	Paredes Galán, Ángel Tommasini, Daniele			
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Web	http://laserphotonics.org			
General description				

Competencies

Code				
A1	Acquire knowledge and understanding that provide a basis or opportunity for originality in developing and / or applying ideas, often in a research context.			
A2	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.			
A3	That the students are able to integrate knowledge and handle complexity and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.			
A4	That the students can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences clearly and unambiguously.			
A5	That the students have the learning skills that enable them to continue studying in a way that will be largely self-directed or autonomous.			
C1	Ability to understand the physical basis of the applications of lasers in various fields of particular relevance, such as metrology, biomedicine, industry and environment. Identification and recognition of new technologies, applications, business systems, regulations on lasers and the development of processes and systems for analysis.			
C6	Ability to use optical instrumentation and the manufacture and assembly of experiments based on techniques of laser and photonics technologies and their applications, autonomously.			
D1	Leadership skills, decision making and time management.			
D5	Initiative and entrepreneurship, stimulated by training in the field of photonics and laser technology.			

Learning outcomes

Expected results from this subject	Training and Learning Results
At the end of the course, the student will have acquired knowledge on the fundamentals of lasers. This will help him in following contents of the rest of subjects of the master, including the laboratories. Moreover, he will be able to solve complex theoretical problems and handle computational methods.	A1 A2 A3 A4 A5 C1 C6 D1 D5

Contents	
Topic	
Introduction	<ul style="list-style-type: none"> - Principles and basic components of the laser. - History of the laser. - Applications of the lasers
Aspects of physics	<ul style="list-style-type: none"> - Electrodynamics - Electromagnetic waves - Lorentz model - Classical aspects of radiation - Quantum aspects of radiation
Physics of the laser	<ul style="list-style-type: none"> - Rate equations - Line broadening - Resonant cavities - Gaussian beam - Pulsed lasers
Laser types	<ul style="list-style-type: none"> - Solid state lasers - Dye lasers - LEDs and diode lasers - Other types of laser
Advanced topics	<ul style="list-style-type: none"> - Nonlinear optics - Other contemporary topics

Planning			
	Class hours	Hours outside the classroom	Total hours
Troubleshooting and / or exercises	10	0	10
Master Session	35	0	35
Autonomous troubleshooting and / or exercises	0	70	70
Multiple choice tests	1	0	1
Jobs and projects	4	30	34

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
	Description
Troubleshooting and / or exercises	In videoconference classes, problems related to the physical principles of lasers will be solved in detail.
Master Session	Interactive videoconference classes, based on the notes that will be given to the students.
Autonomous troubleshooting and / or exercises	Students will learn on themselves by facing similar problems to those solved in the class

Personalized attention	
Methodologies	Description
Autonomous troubleshooting and / or exercises	- During the course, the teacher will propose problems and projects to expose in class. - The professor will give personalized attention to each student to orient, resolve doubts and propose subjects, according to the students' interests.
Tests	Description
Jobs and projects	- During the course, the teacher will propose problems and projects to expose in class. - The professor will give personalized attention to each student to orient, resolve doubts and propose subjects, according to the students' interests.

Assessment					
	Description	Qualification	Training and Learning Results		
Autonomous troubleshooting and / or exercises	Students will solve problems on physical principles of lasers, similars to those seen in the class. Their work will be assessed and feedback will be provided.	40	A1 A2 A3 A4 A5	C1 C6	D1 D5

Multiple choice tests	At the end of the course, a multiple choice test will be proposed to evaluate the competencies acquired by the students.	40	A1 A2 A3 A4 A5	C1 C6	D1 D5
Jobs and projects	Using the videoconference system, the student will make a presentation on a topic of her interest related to the content of the subject.	20	A1 A2 A3 A4 A5	C1 C6	D1 D5

Other comments on the Evaluation

Sources of information

O. Svelto, **Principles of Lasers**, 2010,
B.E.A. Saleh, **Fundamentals of Photonics**,

Recommendations

Other comments

- Attend classes, where the students will obtain a global vision of the operation and the applications of the lasers.
- The autonomous resolution of problems will allow to work personally on useful mathematical models to understand properties of the lasers functioning and propagation.