Bachelor in Physics
(Academic Year 2022-23)

Photonics		Code	800526	Year	4th	Sem.	1st
Module	Applied Physics	Topic	Obligatory of Applied Physics	Character	Optional		

	Total	Theory	Exercises/Lab
ECTS Credits	6	4.2	1.8
Semester hours	45	30	11 | 3

Learning Objectives (according to the Degree's Verification Document)

- *Know the fundamentals of Photonics.*
- *Understand and manage the phenomena associated with anisotropy and polarization: birefringence, dichroism, etc.*
- *Understand the processes and devices involved in the emission and radiation of light*

Brief description of contents

Light propagation in matter; birefringence, dichroism and phenomena associated with polarization; radiation emitters and detectors; introduction to laser; photonic devices.

Prerequisites

It is recomended to have taken the subject of Optics, Electromagnetism II and the Laboratory of Physics III.

Coordinator	Oscar Martinez Matos		Dept.	Optics
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Theory/Exercises – Schedule and Teaching Staff

Group	Lecture Room	Day	Time	Professor	Period/ Dates	Hours	T/E	Dept.
B	5	Tu,Th	14:00-15:30	Rosa Weigand Talavera	Whole semester	42	T	Optics

Office hours

Group	Professor	Schedule	E-mail	Location
B	Rosa Weigand Talavera	1er cuatrimestre presencial M,J 15:30-17:30 online L 15:30-17:30 2º cuatrimestre presencial L,X 12:00-14:00 online M 12:00-14:00	weigand@fis.ucm.es	Despacho 305.0

Teaching Labs – Schedule and Teaching Staff					
Group	**Lecture Room**	**Sessions**	**Professor**	**Hours**	**Dept.**
L3	205.A	M: 13/12/22 14:00-15:30 h J: 15/12/22 14:00-15:30 h	Francisco Javier Hernández Rueda	3	Optics

Syllabus

• Introduction.

• Propagation and interaction of light in material media:

- Measurable parameters.
- Temporary dispersion. Kramers-Krönig relations.
- Anisotropic media. Birefringence and dichroism. Applications (phase shifting films and polarizers).
- Optically active media.
- Induced anisotropies: Faraday Effect, Spatial Light Modulators, etc.
- Non-linear optics effects: Optical Kerr effect.

• Waveguides and optical fibers: modes, propagation speed, dispersion, attenuation.

• Emitters and radiation properties:

- Spontaneous and stimulated emission.
- Spectral line profile.
- Types of light sources.
- Statistics of photons in types of laser, thermal, quantum radiation.
- The laser: Equations of balance, gain, threshold, resonators, types of lasers.

• Photodetectors: Types and characteristics.

Bibliography

- J. M. Cabrera, F. J. López y F. Agulló. Óptica Electromagnética, Addison-Wesley Iberoamericana, Wilmington 1993.
- J. M. Cabrera, F. Agulló y F. J. López, Óptica Electromagnética Vol. II: Materiales y Aplicaciones, Addison Wesley/Universidad Autónoma de Madrid 2000.
- W. Demtröder, Atoms, Molecules and Photons. Springer 2006.
- G. R. Fowles, Introduction to Modern Optics, Dover, New York 1989.
- A. Ghatak, Optics,Mc Graw Hill, 2010
- M. Fox, Quantum Optics. An Introduction, Oxford Univ. Press 2006.
- D. J. Hagan, P.G. Kik, Light-Matter Interaction. Document Open Access 2013- OSE5312.
- F. G. Smith, T. A. King and D. Wilkins, Optics and Photonics. An Introduction, Wiley 2007.
- B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons 2007.

Online Resources

- The teaching material (notes, presentations, videos, links, etc.) used in the classes of theory and practices will be available on the Virtual Campus.

- The tutorials can be carried out by videoconference, through the Virtual Campus of the subject, by email or through any other procedure, prior communication to the teacher or professor.

Methodology
The main concepts of the subject with be explained in theory lectures that will include examples and applications. • Practical lectures of problems and guided activities. • Laboratory sessions. • Exams from previous years will be provided. • A series of problem statements will be provided in advance of their resolution during lectures. Likewise, the delivery of solved problems will be promoted. • Bibliography available in the Faculty Library will be provided. • Use of the Virtual Campus.

Evaluation Criteria		
Exams	**Weight:**	70%
Mandatory final exam		
Other Activities	**Weight:**	30%
The following activities will be valued: -Delivery of proposed problems. - Possible short-duration exercises carried out during lecture hours. - Laboratory sessions. Two laboratory sessions will be carried out at the end of the semester. - Other activities		
Final Mark		
A = Final exam grade on a scale of 0-10 B = Score of other evaluation activities on a scale of 0-10 The final grade C will be the maximum between the continuous assessment grade, C = 0.7 A + 0.3 B, and the final exam grade, C = A. Only the percentages of the continuous evaluation can be applied when the A grade is equal to or greater than 4.5. To pass the course it will be necessary to obtain a final grade equal to or greater than C = 5. The qualification of the extraordinary call will be obtained following the same procedure of evaluation.		