University of the Balearic Islands

Teaching guide

Academic year	2014-15
Subject	11014 - Quantum and Nonlinear Optics
Group	Group 1, 2S
Teaching guide	C
Language	English

Subject identification

Subject	11014 - Quantum and Nonlinear Optics
Credits	0.76 de presencials (19 hours) 2.24 de no presencials (56 hours) 3 de totals (75 hours).
Group	Group 1, 2S
Teaching period	2nd semester
Teaching language	English

Professors

Lecturers	Horari d'atenció als alumnes					
	Starting time	Finishing time	Day	Start date	Finish date	Office
Roberta Zambrini --	You need to book a date with the professor in order to attend a tutorial.					

Contextualisation

Introductory course to quantum optics, including nonlinear phenomena, light matter interaction and matter waves.

Requirements

Recommendable

Knowledge on the quantum physics basics

Skills

Specific

* To be able to identify characteristic properties of quantum systems including nonlinear effects (E16).

Generic

* To be able to describe, both mathematically and physically, complex systems in different situations (TG1).
* To acquire the capacity to develop a complete research plan covering from the bibliographic research and strategy to the conclusions (TG2).
* To write and describe rigorously the research process and present the conclusions to an expert audience (TG3).
* To acquire the ability to ask questions, read and listen critically and participate actively in seminars and discussions (TG4).

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Basic

* You may consult the basic competencies students will have to achieve by the end of the Master's degree at the following address: http://estudis.uib.cat/master/comp_basiques/

Content

Theme content

1. Introduction. Planck's law. Einstein coefficients.
2. Quantization of electro-magnetic field. States.
3. Optical coherence, beam splitters and interferometers.
4. Atom-field interaction: semiclassical and quantum descriptions.
5. Non linear quantum optics: overview.

Teaching methodology

In-class work activities

Modality	Name	Typ. Grp.	Description	Hours
Theory classes	lessons	Large group (G)	Exposition and discussion on the main course contents.	15
Practical classes	exercises	Large group (G)	Exercises	3
Assessment	oral presentation	Large group (G)	Student oral presentation (during 15') of their own 2 pages paper.	1

At the beginning of the semester a schedule of the subject will be made available to students through the UIBdigital platform. The schedule shall at least include the dates when the continuing assessment tests will be conducted and the hand-in dates for the assignments. In addition, the lecturer shall inform students as to whether the subject work plan will be carried out through the schedule or through another way included in the Campus Extens platform.

Distance education work activities

Modality	Name	Description	Hours
Individual self-study	exercises	Exercises.	10
Individual self-study	individual study	Elaboration of the contents of the lessons, reading of related material, book chapters and papers.	28

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Modality	Name	Description	Hours
Individual self-study	paper	Preparation of a two pages paper on a subject suggested during the lessons and of its oral exposition.	18

Specific risks and protective measures

The learning activities of this course do not entail specific health or safety risks for the students and therefore no special protective measures are needed.

Student learning assessment

lessons

Modality	Theory classes
Technique	Short-answer tests **(non-retrievable)**
Description	Exposition and discussion on the main course contents.
Assessment criteria	
Final grade percentage: 20%	

exercises

Modality	Practical classes
Technique	Short-answer tests **(non-retrievable)**
Description	Exercises
Assessment criteria	
Final grade percentage: 20%	

oral presentation

Modality	Assessment
Technique	Oral tests **(non-retrievable)**
Description	Student oral presentation (during 15') of their own 2 pages paper.
Assessment criteria	
Final grade percentage: 60%	

Resources, bibliography and additional documentation

Basic bibliography

R. Loudon, The quantum theory of light, (Oxford University press, 2000).
C. Gerry and P. Knight, Introductory quantum optics (Cambridge Univ. Press, 2004).
S. Haroche and J.-M. Raimond, Exploring the Quantum(Oxford University Press, Oxford, 2005).
M. Orszag, Quantum Optics, (Springer Verlag, 2000).

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Complementary bibliography

Relevant papers provided during the lessons

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