

Syllabus

Subject

Subject / Group	11014 - Quantum and Nonlinear Optics / 1
Degree	Master's in Physics of Complex Systems
Credits	3
Period	2nd semester
Language of instruction	English

Professors

Lecturers	Office hours for students					
	Starting time	Finishing time	Day	Start date	End date	Office / Building
Gian Luca Giorgi -	14:30	16:30	Monday	01/02/2019	01/07/2019	106/ Edifici Institut Universitari de Recerca
Roberta Zambrini -	15:30	16:30	Tuesday	03/09/2018	01/07/2019	206

Context

Introductory course on interaction between light and matter including classical and quantum phenomena.

Requirements

Recommended

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)

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- * 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)

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

Range of topics

1. Planck law and Einstein coefficients. Quantization of electromagnetic field.
2. Quantum theory of coherence. Light quantum states.
3. Light matter interaction. Photons and spins.
4. Nonlinear processes; generation of quantum states and entanglement

Teaching methodology

In-class work activities (0.76 credits, 19 hours)

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 of their own 2 pages paper. Subject decided during the course.	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 Aula Digital platform.

Distance education tasks (2.24 credits, 56 hours)

Modality	Name	Description	Hours
Individual self-study	exercises	Exercises.	10

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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
Individual self-study	individual study	Elaboration of the contents of the lessons, reading of related material, book chapters and papers.	28

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

Frau en elements d'avaluació

In accordance with article 33 of Regulation of academic studies, "regardless of the disciplinary procedure that may be followed against the offending student, the demonstrably fraudulent performance of any of the evaluation elements included in the teaching guides of the subjects will lead, at the discretion of the teacher, a undervaluation in the qualification that may involve the qualification of "suspense 0" in the annual evaluation of the subject".

lessons

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

exercises

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



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oral presentation

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

Resources, bibliography and additional documentation

Basic bibliography

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

Complementary bibliography

Relevant papers provided during the lessons

