Last update: 13-05-2015

230555 - QO - Quantum Optics

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 1022 - UAB - (ANG) pendent

Academic year: 2015

Degree: ERASMUS MUNDUS MASTER'S DEGREE IN PHOTONICS ENGINEERING, NANOPHOTONICS AND BIOPHOTONICS (Syllabus 2010). (Teaching unit Optional)
MASTER'S DEGREE IN PHOTONICS (Syllabus 2013). (Teaching unit Optional)

ECTS credits: 3 Teaching languages: English

Teaching staff

Coordinator: Verònica Ahufinger, UAB.

Others: Jordi Mompart, UAB.

Opening hours

Timetable: veronica.ahufinger@uab.cat

jordi.mompart@uab.cat

Degree competences to which the subject contributes

Transversal:

2. ENTREPRENEURSHIP AND INNOVATION: Being aware of and understanding how companies are organised and the principles that govern their activity, and being able to understand employment regulations and the relationships between planning, industrial and commercial strategies, quality and profit.
3. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.
4. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.
5. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

Teaching methodology

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Learning objectives of the subject

This course will provide a wide-ranging introduction to the field of quantum optics, developing in detail the semiclassical and quantum approaches to light-matter interaction.

BIBLIOGRAPHY

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·On line

Daniel A. Steck, Quantum and Atom Optics (2007)
Oregon Center for Optics and Department of Physics. Oregon University
http://atomoptics.uoregon.edu/~dsteck/teaching/quantum-optics/quantum-optics-notes.pdf

·Basic

P. Meystre and M. Sargent, Elements of Quantum Optics, Springer, 1990.
M.O. Scully, M.S. Zubairy, Quantum Optics, Cambridge U. P., 1997.
Walls, G.J. Milburn, Quantum Optics, Springer-Verlag, 1994.

C. Gerry and P. Knight, Introductory Quantum Optics, Cambridge University Press, 2005.

·Advanced

C. Cohen-Tannoudji, J. Dupont-Roc, G. Grynberg, Atom-Photon Interactions. John Wiley & Sons, 1992.
C. Cohen-Tannoudji, J. Dupont-Roc, G. Grynberg, Photons and Atoms. Introduction to Quantum Electrodynamics. John Wiley & Sons, 1992.

Study load

Total learning time: 75h	Theory classes:	22h 30m	30.00%
	Practical classes:	0h	0.00%
	Laboratory classes:	0h	0.00%
	Guided study:	2h 15m	3.00%
	Self study:	50h 15m	67.00%

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Content

1.- Semiclassical theory of atom-field interaction

Degree competences to which the content contributes:

Description:
Rate equations. Schrödinger equation. Two-level atom under the RWA. AC-Stark splitting. Dressed atom. Rabi oscillations. Mollow triplet. Autler-Townes doublet. Dipole force. Density matrix formalism. Two and three-level atoms. Coherent population trapping. Electromagnetically Induced Transparency. Stimulated Raman Adiabatic Passage.

2.- Quantum theory of atom-field interaction

Degree competences to which the content contributes:

Description:
Classical Electrodynamics. Quantization of the e.m. field. Quantum states of the free e.m. field. Vacuum states. Coherent States. Squeezed states. Jaynes-Cummings model. Weisskopf-Wigner treatment for spontaneous emission. Quantum Rabi Oscillations. Collapses and revivals. Cavity quantum electrodynamics.

Qualification system

Attendance to be evaluated: >80% of the lecture time

- Oral exam (70%)
- Homework assessments (30%)

Bibliography