Syllabus

Subject

Subject / Group	11289 - Electronic Nanostructures / 1
Degree	Master's in Advanced Physics and Applied Mathematics
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**
David Sánchez Martín david.sanchez@uib.es	14:00	15:00	Tuesday	09/09/2019	29/05/2020	205 (IFISC, Edifici Instituts de Recerca)
Llorenç Serra Crespí llorens.serra@uib.es	14:00	15:00	Monday	16/07/2019	31/07/2020	209, edifici Instituts

Context

COURSE:

Nanotechnology aims at controlling the behavior of matter at the atomic and molecular level. The potential of nanostructures is huge; they may form the building blocks of the next industrial revolution. The main ideas of nanoscience were already discussed by Feynman in 1959: atom arrangment at will, tiny motors, better microscopes, computer miniaturization, etc. In the last few decades, spectacular achievements have been made using novel materials and tools: quantum dots, carbon nanotubes and molecular transistors, just to mention a few. These systems must be understood with quantum transport techniques, which make them attractive not only for practical applications but also for the fundamental understanding of quantum matter out of equilibrium.

PROFESSORS:

David Sánchez (PhD in Physics, 2002) is an Associate Professor at the UIB. He has published over 100 research papers and has taught different courses in quantum mechanics, nanostructures, mathematical methods and general physics. Llorenç Serra (PhD in Physics, 1992) is a Professor at the UIB. He has published more than 130 research papers mainly on Nanophysics and taught courses mostly on applications of quantum mechanics such as on Nanostructures, as well as on Atomic, Molecular and Nuclear Physics.

Requirements

Date of publication: 15/07/2019

Recommended

Background on quantum mechanics, statistical mechanics and solid state physics.

Skills

Specific

* ESQ5 - Understanding of physical properties of low-dimensional semiconductors in external fields
* CE2 - Students must possess the ability to use and adapt mathematical models to describe physical phenomena of different nature
* CE3 - To acquire edge-line knowledge in the international scientific research context and demonstrate a full comprehension of theoretical and practical aspects, together with the scientific methodology

Generic

* CG1 - Systematic comprehension of a field of knowledge and its related skills and research methods
* CB7 - Students can apply the broader (or multidisciplinary) acquired knowledge and ability to solve problems in new or unfamiliar environments within contexts related to their field of study
* CB10 - Students gain the learning skills that enable them to continue studying in a way that will be largely self-directed or autonomous

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. Low dimensional systems
2. Semiconductor nanostructures
3. Quantum transport in nanostructures
4. Aharonov-Bohm interference and Berry phases
5. Quantum Hall effect
6. Optical arbsoption in nanostructures and quantum optics

Teaching methodology

In-class work activities (0.88 credits, 22 hours)

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Modality	Name	Typ. Grp.	Description	Hours
Theory classes	Lectures	Large group (G)	Discuss the main theoretical concepts with the aid of selected examples.	20
Assessment	Exam	Large group (G)	Solve the proposed short questions and problems.	2

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 (2.12 credits, 53 hours)

Modality	Name	Description	Hours
Individual self-study	Homework assignments	Solve the proposed list of problems.	20
Individual self-study	Study	Master the concepts explained in the lectures	33

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".

Date of publication: 15/07/2019

Exam

Modality	Assessment
Technique	Extended-response, discursive examinations **(retrievable)**
Description	Solve the proposed short questions and problems.
Assessment criteria	Good application of knowledge and skills acquired during term course.

Final grade percentage: 50%with a minimum grade of 3

Homework assignments

Modality	Individual self-study
Technique	Extended-response, discursive examinations **(non-retrievable)**
Description	Solve the proposed list of problems.
Assessment criteria	Clear discussion and correct answers.

Final grade percentage: 50%

Resources, bibliography and additional documentation

Basic bibliography

- T. Ihn, "Semiconductor nanostructures", OUP (2009).

Complementary bibliography

- S. Datta, "Electronic Transport in Mesoscopic Systems", CUP (2003).

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