University of the Balearic Islands

Teaching guide

Academic year	2014-15
Subject	11291 - Spintronics
Group	Group 1, 2S
Teaching guide	A
Language	English

Subject identification

Subject	11291 - Spintronics
Credits	0.72 de presencials (18 hours) 2.28 de no presencials (57 hours) 3 de totals (75 hours).
Group	Group 1, 2S (Campus Extens)
Teaching period	2nd semester
Teaching language	English

Professors

Lecturers	Horari d'atenció als alumnes					
	Starting time	Finishing time	Day	Start date	Finish date	Office
María Rosa López Gonzalo rosa.lopez-gonzalo@uib.es	09:30h	10:30h	Monday	01/09/2014	30/06/2015	208
David Sánchez Martín david.sanchez@uib.es	10:00h	11:00h	Tuesday	09/02/2015	29/05/2015	205, IFISC (Edifici Instituts de Recerca)
Llorenç Serra Crespí llorens.serra@uib.es	14:30h	15:30h	Thursday	09/02/2015	30/06/2015	209

Contextualisation

Spintronics is an emerging field of physics which exploits the properties of the spin degree of freedom. Exciting discoveries in recent years include giant magnetoresistance, spin torques and spin Hall effect. From a more practical point of view, spintronic devices will have a significant impact in future electronics due to their lower power consumption and their novel functionalities.

Requirements

Recommendable

Quantum mechanics. Solid state physics.

Skills

Date of publication: 15/07/2014

Specific

* ESQ7: Understanding of the magnetic properties of solids and their applications for nanoelectronic devices..

Generic

* CB1, CB2, CB5.

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

   Magnetism in solids. Zeeman effect. Magnetic interactions: exchange and superexchange. Ferromagnetism. Stoner model. Magnetic semiconductors. Spin-orbit interaction in semiconductors: Rashba and Dresselhaus.

2. Spin decoherence

   Spin relaxation. Bloch equations. Times T1 and T2. Elliot-Yafet and Dyakonov-Perel mechanisms. Hyperfine interaction.

3. Nanoscale spintronics

   Giant magnetoresistance. Tunnel magnetoresistance. Spin-torque transfer. Spin field-effect transistor. Ferromagnetic-semiconductor interfaces. Spin Hall effect.

4. Spin quantum computation

   Qubits. Quantum dots.

Teaching methodology

In-class work activities

Modality	Name	Typ. Grp.	Description	Hours
Theory classes		Large group (G)	Lectures.	18

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.

Date of publication: 15/07/2014

Distance education work activities

Modality	Name	Description	Hours
Individual self-study	Presentation.	Present and discuss a relevant paper in the field of spintronics.	37
Individual self-study	Problems.	Solve the proposed list of problems.	20

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

Presentation.

Modality	Individual self-study
Technique	Papers and projects **(non-retrievable)**
Description	Present and discuss a relevant paper in the field of spintronics.
Assessment criteria	

Final grade percentage: 50%

Problems.

Modality	Individual self-study
Technique	Papers and projects **(retrievable)**
Description	Solve the proposed list of problems.
Assessment criteria	

Final grade percentage: 50%

Resources, bibliography and additional documentation

Basic bibliography

Fabian, Jaroslav, et al. "Semiconductor spintronics." Acta Physica Slovaca. Reviews and Tutorials 57.4-5 (2007): 565-907.

Wolf, S. A., et al. "Spintronics: a spin-based electronics vision for the future." Science 294.5546 (2001): 1488-1495.

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