Introduction to spintronics

Academic Year: (2022 / 2023) **Review date: 17-06-2022**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: ACEDO GALLARDO, PABLO

Type: Electives ECTS Credits : 6.0

Year : 5 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Materials science and engineering
Solid State Fundamentals for Engineering
Electronic Engineering Fundamentals
Quantum Physics

OBJECTIVES

To learn what is spintronics and the physical fundamentals supporting it. To understand the working principles of some basic spintronics devices, and the materials used to develop them.

Introduction to the current paths for future spintronics: spinorbitronics and advanced computational techniques.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction. Magnetism and magnetic materials. Connection between quantum concepts and macroscopic magnetic measurements. Spin and spin-orbit coupling.
2. Spintronics. Definition, origin and classes.
3. Origin of spintronics. Giant magnetoresistance and spin valves.
4. Tunnel magneto-resistance and magnetic tunnel junctions.
5. Spin injection and transport in semiconductors.
6. Spin transfer torque. Applications in the development of spintronics devices.
7. Direct and inverse spin Hall effects.
8. Materials for spintronics. Nanostructures.
9. Advanced spintronics: spinorbitronics and chiral systems.
10. Further advanced applications of spintronics: quantum computing and artificial intelligence.

LEARNING ACTIVITIES AND METHODOLOGY

AF1. THEORETICAL-PRACTICAL CLASSES.
AF3. STUDENT INDIVIDUAL WORK OR GROUP WORK.
AF8. WORKSHOPS AND LABORATORY SESSIONS.
AF9. FINAL EXAM.
MD1. THEORY CLASS.
MD2. PRACTICAL CLASS.

ASSESSMENT SYSTEM

SE1. FINAL EXAM. 50%
SE2. CONTINUOUS EVALUATION.

- Partial Exam: 20%.
- Students' projects and practical work: 30%.

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

BASIC BIBLIOGRAPHY

- Puja Dey, Jitendra Nath Roy Spintronics. Fundamentals and Applications, Springer, 2021

ADDITIONAL BIBLIOGRAPHY

- A. Fert Nobel lecture: Origin, development and future of spintronics, Rev. Mod. Phys. 80, 1517 , 2008
- Several Authors The annual Magnetism Roadmaps of. J. Phys. D: Applied Physics , IOP, 2021