

UE Magnetism and nanosciences



Level
Baccalaureate
+4



ECTS
3 credits



Component
UFR PhITEM
(physique,
ingénierie, terre,
environnement,
mécanique)



Semester
Automne

- > **Teaching language(s):** English
- > **Open to exchange students:** Yes
- > **Code d'export Apogée:** PAX7NQAF

Presentation

Description

Goal: Magnetism is widely present in our daily environment, especially through the use of magnetic materials (motors and actuators, magnetic recording, MRI etc.). It is also a very active field of fundamental research, particularly in Grenoble. Meso- and macroscopic aspects are presented in details and the complex magnetic structures that are the subject of current research are discussed.

Content: This course is based on the following plan.

- I) Magnetism at atomic level, magnetic behaviours, magnetic ordering
- II) Magnetostatics (electromagnetism, definitions, demagnetizing field, linear magnetism, units)
- III) Experimental techniques
- IV) Phenomenology, mesoscopic magnetism (anisotropy, magnetization reversal, domain walls)
- V) Spin-dependent transport-Spintronics (Electronic transport in ferromagnets, Giant Magnetoresistance (GMR), Spin dependent tunneling, Magnetic tunnel junctions)

Tutorials: Magnetostatics; magnetic orders, magnetic moments ; magnetic anisotropy ; magnetization reversal ; domain walls ; spin dependent transport

Labwork: Students will follow 2 labworks among 4:

Vibrating sample magnetometer (inductive measurement of hysteresis loop for a ferromagnetic sample, anisotropy)
Susceptibility (measurement of temperature evolution of susceptibility, Curie-Weiss law),

SQUID (use of a SQUID magnetometer to measure magnetic fields)
Magnetotransport (extraordinary Hall effect and giant magnetoresistance measurements)

Prerequisites: Knowledge in electromagnetism and solid state physics

Bibliography:

Magnetism vol 1, dir E. de Lacheisserie, PUG (1999)

EDP Sciences Introduction to Solid State Physics,

C. Kittel Solid State Physics

N. Ashcroft and N. Ashcroft. Mermin Magnetism and Magnetic Materials, J.M.D. Coey

Course parts

UE Magnetism and nanosciences - CMTD	Lectures (CM)	20h
UE Magnetism and nanosciences - TP	Practical work (TP)	8h

Period : Semester 7

Useful info

Campus

› Grenoble - Saint-Martin d'Hères