Level: master

Course title: Magnetic properties of materials

Status: elective

ECTS: 9

Requirements: passing the exam in Condensed Matter Physics

Learning objectives

Introducing students to the broader phenomenon of magnetic materials. Introducing the magnetic structure of materials and the possibility of their applications. Mastering modern experimental techniques in the study of magnetic properties.

Learning outcomes

Upon completion of the course, students should have developed:

- General skills: knowledge of metrology and ability to follow professional literature.
- Subject-specific skills: knowledge of the experimental techniques for determining the
- magnetic properties of materials.

Syllabus

Theoretical instruction

Units in magnetism. Classification of materials in relation to magnetic properties. The magnetization and susceptibility dependence of the sample composition, temperature and field. Magnetism of ionic compounds. Magnetism of metals and alloys. Formation of magnetic fields: solenoids, superconducting solenoids, electromagnets with iron core. Pulsed fields. Measuring the magnetic field. Measurements of magnetization and susceptibility in stationary and alternating regime: induction method, vibration magnetometer, Faraday's method, Gouy's method, SQUID. The spontaneous magnetization and Curie temperatures based on experimental data. NMR, EPR, determination of g-factor. Material testing method of the hyperfine interaction. Detection of neutrons as a method of determination of magnetic structures. Inelastic scattering and magnons. Determination of magneto-crystal anisotropy and magnetostriction, magnetostricted materials. Magnetically hard and soft materials. Determination of domains and domain walls. Permanent magnetic and paramagnetic materials. Determination of ferromagnetic impurities in the paramagnetics.

Practical instruction

Experimental exercises that accompany the course content.

Weekly teaching load				Other:
Lectures: 3	Exercises: 1	Other forms of teaching: 1	Student research:	