Level: bachelor

Course title: Transport processes

Status: elective

ECTS: 6

Requirements:

Learning objectives

Acquisition of up-to-date knowledge related to the transport processes and their potential application in advanced materials.

Learning outcomes

After mastering the course, students should have:

- Ability of scientifically based understanding of the transport processes;
- Ability to use the scientific literature and prepare the scientific presentations;
- Ability to independently perform measurements and experiments related to electrical and galvanomagnetic effects;
- Ability to transfer the acquired knowledge to other individuals and groups.

Syllabus

Theoretical instruction

Types of transport processes. Boltzmann kinetic equation. Electrical conductivity in ordered systems. Electronic conductivity and the types of materials. Ion and proton conductivity. Photoconductivity. Electrical conductivity in disordered semiconductor systems. Electrical conductivity in direct and alternating current. Conductivity in liquid state. Superconductivity. Fundamentals of London and the quantum (BCS) superconductivity postulates.
Thermal conductivity. Lattice vibrations. Phonons. The mechanisms of heat transfer. Galvanomagnetic phenomena. Hall voltage. Magnetoresistance. Nernst–Ettingshausen effect. Thermoelectrical phenomena. Seebeck effect. Electrothermal Peltier effect and Thomson effect. Thermomagnetic phenomena. Righi-Leduke effect. Maggi-Righi-Leduke effect. Transverse Nernst-Ettingshausen effect. Longitudinal Nernst-Ettingshausen effect.

Practical instruction

Exercises, Other forms of teaching, Student research.

Computational exercises that follow the content of lectures; preparing and presenting the seminar papers; experimental measurements related to conductivity and other transport processes.

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