Program	Level of studies		**First cycle**	
	Program name		**Physics**	
Course name	**SOLID STATE PHYSICS II**			
Course ID	Semester	Course status	ECTS	L+E
PCM6511	**VI**	**MANDATORY**	**5**	**2+2**
Lecturer	**Prof. dr. Suada Sulejmanović**			
Aims and intended learning outcomes	Aim of the course is to familiarize students with complicated problems and concepts in solid state physics and demonstrate how solid state physics explains some basic properties of materials: optical, transport, magnetic and thermodynamic properties. After they complete the course, students should be able to understand how the periodic crystal structure is reflected on the electronic structure of the solid and describe the electronic structure (ground state and excitation spectrum) of metals and insulators, relation between the electronic structure of the solid and their dielectric, magnetic and superconducting properties, use some several models to calculate the polarization, magnetization and superconductivity in the solid state.			

Course content

Metals: free electron model. Electrons in a periodic potential. Bloch's theorem. The Kronig-Penney model. Tight binding approximation. Weak binding approximation. Band gap and diffraction phenomena. Brillouin zone of one- and two-dimensional lattices. Brillouin zone of BCC and FCC lattices. Fermi surface and Brillouin zone. Extended, reduced and periodic zone schemes. Electron motion in a periodic field of a crystal – effective mass. Band filling – conduction and valence band in insulators, semiconductors and conductors. Transport properties of metals. Classical and quantum theory.
Semiconductors: intrinsic and extrinsic (doped). Fermi level in semiconductors, charge carrier density and mobility. Electron and hole densities in thermal equilibrium. Doping of semiconductors. Properties of p-n junction. Dielectric properties of matter. Deformation, electronic, ionic, orientation polarisability.
Magnetic properties of solids: diamagnetism, paramagnetism, ferromagnetism. Magnetisation curve – hysteresis. Magnetic properties of atoms. Temperature effect on magnetic properties. Magnetic anisotropy of crystals. Magnetostriction. Domain structure of ferromagnetic materials.
Superconductivity. Energy gap. Meissner effect. Theory of superconductivity. London equations. Type II superconductors. Josephson effect.

Student workload (hours)		Grading	
Lectures and Exercises	60	Assessment method	Points
Exam preparation	35	Homework	10
Assignments	15	Midterm exam	50
Consultation	15	Final exam	40
Total	125	Total	100

Literature

1. M.Pirić: Osnove kvantne mehanike, statističke fizike i fizike čvrstog stanja, Univerzitetska knjiga, Sarajevo 2007.
2. Ch. Kittel: Uvod u fiziku čvrstog stanja, Savremena administracija, Beograd, 1970.
3. V. Knapp, P. Colić: Uvod u električna i magnetna svojstva materijala, Školska knjiga Zagreb, 1990.
4. H. Ibach, H. Lüth: Solid-State Physics An introduction to Principle of Material Science, Springer, 2009

Remarks

Midterm exam – 9th week of classes