Specification for the book of courses

Study program	Electrical Engineering and Computer Science		
Module	Common		
Type and level of studies	Doctoral studies		
The name of the course	Semiconductor Physics		
Lecturer (for lectures)	Prijić P. Aneta		
Lecturer/associate (for exercises)			
Lecturer/associate (for OFE)			
Number of ECTS	10	**Course status (obligatory/elective)**	Elective
Prerequisites			
Course objectives	Objectives of the course are focused on: - Refining knowledge in the field of crystal structure and quantum solid state physics; - Detailed analysis of the transport of carriers through semiconductors; - Consideration of non-equilibrium phenomena in the P-N and the metal-semiconductor junction; - Introduction to the charge sheet model of MOS structures; - Detailed analysis of C-V plots of MOS capacitors; - Study of the effects characteristic for the MOS transistors at a level of very large scale integration; - Getting acquainted with structures based on heterojunctions and semiconductor compounds; - In-depth consideration of the functioning of optoelectronic devices.		
Course outcomes	Learning outcomes allow a student to: - Explain the zonal theory in crystals from the aspect of the quantum-mechanical theory of a solid state; - Compare the classical relations for the transport of charge carriers in a semiconductor with particular solutions of the Boltzmann's kinetic equation; - Explain in detail the generation-recombination and diffusion processes in the semiconductors; - Highlight the specificity of the metal-semiconductor junction and heterojunction; - Present the charge sheet model of MOS structures: - Determine the characteristics of the specified MOS capacitor on the basis of its C-V plot; - Analyze the effects of MOS transistors scaling at a level of very large scale integration; - Explain in-depth the functioning of optoelectronic devices.		
Course outline			
Theoretical teaching	Crystal structure and solid state theory. Quantum and statistical physics of a solid state. Boltzmann's kinetic equation. Semiconductor in thermal equilibrium. Excess carrier concentrations and transport of carriers. Generation-recombination mechanisms. Metal-semiconductor junction and P-N junction. Non-equilibrium phenomena in the P-N junction and transport equations. Models of carriers mobility. MOS structure. Charge sheet model and C-V plot. MOS transistors and short channel effects. Parasitic effects, hot carriers, high temperature effects. Bipolar devices. SiGe, HEMT and other heterojunction devices. Solar cells, photodetectors, LEDs and laser diodes.		
Practical teaching (exercises, OFE, study and research			
Textbooks/references			
1	S. Sze, K. Ng, "Physics of Semiconductor Devices", 3rd Edition, Wiley-Interscience, 2007 - selected chapters.		
2			
3			
4			
5			

Number of classes of active education per week during semester/trimester/year

Lectures	**Exercises**	**OFE**	**Study and research work**	**Other classes**
3	0	0	0	0

Teaching methods	Consulting teaching; Participation in the realization of scientific-research projects; Inclusion in the teaching process at bachelor and master academic studies; Seminars and projects.

Grade (maximum number of points 100)

Pre-exam duties	**Points**	**Final exam**	**Points**
Activity during lectures		**Written exam**	
Exercises	30	**Oral exam**	40
Colloquia			
Projects	30		