Specification for the book of courses

Study program	Electronics and Microsystems
Module	Electronics and Microsystems
Type and level of studies	Master studies
The name of the course	Multi-Layer Printed Circuit Boards Design
Lecturer (for lectures)	Prijić D. Zoran, Danković M. Danijel
Lecturer/associate (for exercises)	Stojković S. Aleksandra
Lecturer/associate (for OFE)	Marjanović B. Miloš

Number of ECTS	5	**Course status (obligatory/elective)**	Elective

Prerequisites	

Course objectives	Learning objectives are defined so that the student will: - Learn the technology of producing multilayer printed circuit boards; - Learn the process of designing multilayer printed circuit boards; - Learn the sources of parasitic effects that may appear on the multilayer printed circuit board; - Understand ways to reduce the impact of parasitic effects; - Know techniques for the realization of planar components on the printed circuit board; - Know techniques for interconnecting integrated circuits on the multilyer printed circuit board; - Be able to use the ECAD package for the design of multilayer printed circuit boards of medium complexity.
Course outcomes	Learning outcomes are defined so that the student will: - Distinguish the elements of the structure of multilayer printed boards and the technology of their production; - Explain the procedure for designing multilayer printed boards using the given example; - Distinguish grounding topologies and ways of partitioning the ground level, according to the given examples; - Identify sources of parasitic effects and propose ways to minimize them, according to the given examples; - Design planar components on the printed circuit board according to the given technical specifications, using the ECAD package; - Arrange and interconnect on the printed circuit board an integrated circuit with a large number of copies, using ECAD package; - Identify heat sources on the printed circuit board and design appropriate structures for heat removal.

Course outline	
Theoretical teaching	Technology of production of multilayer printed boards. Buried and the blind vias. Distribution of signal type by layers. Ground loops, grounding topology, partitioning the ground level. Power and current flows. Signal integrity. Impact of noise, guard rings. Influence of parasitic components between and within layers. Effects of high frequencies. Electromagnetic interference and crosstalk. Arrangement and ways of connecting integrated circuits with a large number of pins. Planar components on the printed circuit board (sensors, transformers, antennas). Distribution of temperature inside the board structure. The influence of connected peripheral components.
Practical teaching (exercises, OFE, study and research	Using the ECAD package. Laboratory exercises. Research work related to a given or self-proposed subject.

Textbooks/references	
1	https://www.nxp.com/files-static/training_pdf/WBNR_PCBDESIGN.pdf
2	https://www.analog.com/media/en/training-seminars/design-handbooks/Basic-Linear-Design/Chapter12.pdf
3	D. Brooks, "Signal Integrity Issues and Printed Circuit Board Design", Prentice Hall, 2003.
4	D. Brooks, "PCB Currents: How They Flow, How They React", Prentice Hall, 2013.
5	

Number of classes of active education per week during semester/trimester/year				
Lectures	Exercises	OFE	Study and research work	Other classes
2	2	1		
Teaching methods	Active teaching; Lectures; Exercises on the computer; Exercises in the laboratory; Consultations.			
Grade (maximum number of points 100)				
Pre-exam duties		Points	Final exam	Points
Activity during lectures		10	Written exam	25
Exercises		20	Oral exam	25
Colloquia				
Projects		20		