

Specification for the book of courses

Study program		Electrical Engineering and Computer Science		
Module		Electronics - Electronic Circuits and Embedded Systems		
Type and level of studies		Undergraduate Academic Studies		
The name of the course		Digital Integrated Circuits Design		
Lecturer (for lectures)		Andrejević-Stošović V. Miona, Petković M. Predrag		
Lecturer/associate (for exercises)		Mirković D. Dejan		
Lecturer/associate (for OFE)		Mirković D. Dejan		
Number of ECTS	5	Course status (obligatory/elective)	Obligatory	
Prerequisites				
Course objectives	Adoption and systematization of knowledge necessary for full custom digital integrated circuits design and semicustom design based on standard cells (ASIC).			
Course outcomes	Acquiring of competences for designing digital integrated circuits at the transistor level. Students are expected to learn to dimensionalize transistors in digital circuits, use programs for automatic synthesis, verification and physical design of integrated circuits, and learn how to write and present the result of their work.			
Course outline				
Theoretical teaching	Metrics for quality assessment of designed digital integrated circuits. The process of manufacturing CMOS integrated circuits. Design rules. MOS transistor, PN junction and wiring from the perspective of the designer of digital integrated circuit. Trade of speed, consumption and area. Placement and routing. Signal integrity. Parasitic effects on connections (clock-skew, crosstalk, antenna effect). Connection models. CMOS inverter. Complex gates. Combinational and sequential CMOS gates. Memory cells. Models of delay and consumption. Analysis and design of standard digital cells at the transistor level. Symbolic design (stick diagram). Physical design (layout). Electrical characterization of cells by SPICE simulation. Extraction of parameters and characterization after layout generation (DRC, LVS, QRC / PEX). Automation of the cell characterization process.			
Practical teaching (exercises, OFE, study and research)	Students improve their knowledge obtained in lectures by acquiring design skills using professional software packages for the design of integrated circuits: Cadence and Mentor Graphics.			
Textbooks/references				
1	Branko L. Dokić, Predrag M. Petković. Analiza i projektovanje CMOS Digitalnih Integriranih Kola, Akademski misao Beograd, 2017.			
2	Jan M. Rabaey, Anantha P. Chandrakasan, and Borivoje Nikolic. Digital integrated circuits: a design perspective. Vol. 2. Englewood Cliffs: Prentice hall, 2002.			
3	Neil HE Weste and David Harris. CMOS VLSI design: a circuits and systems perspective. Pearson Education India, 2015.			
4				
5				
Number of classes of active education per week during semester/trimester/year				
Lectures	Exercises	OFE	Study and research work	Other classes
2	1	2	0	0
Teaching methods	Lectures, Auditory exercises, practical exercises and examples, projects			
Grade (maximum number of points 100)				
Pre-exam duties	Points	Final exam	Points	
Activity during lectures	10	Written exam	0	
Exercises	20	Oral exam	30	
Colloquia	0			
Projects	40			