

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		Analog Integrated Circuits Design		
Lecturer (for lectures)		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)	Elective	
Prerequisites	Basics of electronics, Analog electronics			
Course objectives	Acquiring knowledge requested for successful design and verification of CMOS analog integrated circuits at transistor level.			
Course outcomes	Acquiring of competence for: design and dimensioning of analog electronic circuits at transistor (device) level for target CMOS process node, verification of the design at functional and technology level by using CAD/EDA tools, working under NIX operating system, report writing and presentation.			
Course outline				
Theoretical teaching	CMOS process. Challenges and properties in the process of implementation of analog integrated circuits (IC) in CMOS technology. MOS structure and PN junction from analog IC designer perspective. Passive components in CMOS. Basic building blocks of analog IC. Sources of noise in IC. Models for analysis. Selection of analog IC topology based on target application. Speed/Power/Area trade-off in analog IC (optimization). Design of analog IC block according to specification (user requirements). Techniques and methods for device sizing in sub-micron CMOS process. Design flow for analog IC. Design rules. Foundry support in analog IC design (Process Design Kit). Simulation models. Verification of analog IC topology by means of SPICE simulations. Physical implementation (layout). Extraction of parasitic components from layout. Characterization after implementation (post-layout simulations). Automation of design characterization process. Preparing data for fabrication. Project documentation, report writing.			
Practical teaching (exercises, OFE, study and research)	Acquired knowledge in lectures is deepened through set of hands-on sessions with professional CAD/EDA tools for analog IC design (Cadence, Mentor Graphics).			
Textbooks/references				
1	P. E. Allen, D. R. Holberg, CMOS Analog Circuit Design 2nd edition, 2002, ISBN 0-19-511644-5.			
2	Behzad Razavi, Design of Analog Integrated Circuits, 2000. ISBN 0-07-238032-2.			
3	Baker R. Jacob, CMOS: circuit design, layout, and simulation, Fourth Edition. John Wiley & Sons, 2019. ISBN 9781119481515.			
4	Hans Camenzind, Designing Analog Chip, Copyright 2004, 2005 Hans Camenzind.			
5	Allan Hasting, The art of Analog Layout, PRENTICE HALL, 2001, ISBN 0-13-087061-7.			
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; Laboratory exercises on computer; Consultations; Individual and group 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			