

## Specification for the book of courses

<b>Study program</b>		Electrical Engineering and Computer Science		
<b>Module</b>		Electronics - Electronic Circuits and Embedded Systems		
<b>Type and level of studies</b>		Undergraduate Academic Studies		
<b>The name of the course</b>		VLSI Design		
<b>Lecturer (for lectures)</b>		Petković M. Predrag		
<b>Lecturer/associate (for exercises)</b>		Jovanović D. Borisav		
<b>Lecturer/associate (for OFE)</b>		Jovanović D. Borisav		
<b>Number of ECTS</b>	5	<b>Course status (obligatory/elective)</b>	Obligatory	
<b>Prerequisites</b>	Electronics, Digital electronics			
<b>Course objectives</b>	Adoption and systematization of knowledge related to the Very Large Scale Integration (VLSI) design			
<b>Course outcomes</b>	Acquiring competence for design of VLSI circuits from VHDL description until the layout design			
<b>Course outline</b>				
<b>Theoretical teaching</b>	VLSI technology. VLSI system structure. Design of VLSI architecture. High level synthesis, RTL level synthesis. Fast adder design. Multiplier RTL level design. Integration of IP blocks in VLSI ICs. VLSI microprocessor design. Controller/datapath partitioning. Micro-instructions. Datapath blocks design. Timing requirements in synchronous circuits. Clock signal. Setup and hold timing requirements. Minimal clock period. Positive, negative clock skew. Clock tree design. Timing requirements in asynchronous circuits. Two-phase and four-phase handshaking protocol. Power supply lines design in integrated circuits. Low power IC design. Sources of static and dynamic power dissipation. Leakage currents sources. Low power design at architecture level. Power gating. Multi voltage islands.			
<b>Practical teaching (exercises, OFE, study and research work)</b>	In practical exercises, using state-of-the-art IC design CAD tools, students widen their theoretical knowledge in the field of VLSI design, gained during the lectures. Students gain new skills how to write technical documentation during the process of documentation writing about IC design project which they implement. The practical VLSI projects include: design of 16-bit Carry Look Ahead adder, the combinatorial and sequential multipliers design, such as Booth and Shift/Add. IIR filter design. Students learn how to write specifications for timing requirements of digital circuits using state-of-the art IC design tools. Practical Back-end IC design includes: floor-planning, placement, routing, clock tree synthesis. Logical verification. Layout design of RISC instruction set microcontroller.			
<b>Textbooks/references</b>				
1	M. Damjanović, B. Jovanović, VLSI Design, lecture notes			
2	K.C. Chang, Digital Systems Design with VHDL, An Integrated Approach, IEEE Computer Society, ISBN 0-7695-0023-4			
3				
4				
5				
<b>Number of classes of active education per week during semester/trimester/year</b>				
<b>Lectures</b>	<b>Exercises</b>	<b>OFE</b>	<b>Study and research work</b>	<b>Other classes</b>
2	1	1	0	0
<b>Teaching methods</b>	Lectures, auditory excercises, laboratory practice, consultations, projects.			
<b>Grade (maximum number of points 100)</b>				
<b>Pre-exam duties</b>	<b>Points</b>	<b>Final exam</b>	<b>Points</b>	
<b>Activity during lectures</b>	10	<b>Written exam</b>		
<b>Exercises</b>	10	<b>Oral exam</b>	30	
<b>Colloquia</b>				
<b>Projects</b>	50			