

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		Embedded Systems Design		
Lecturer (for lectures)		Nikolić R. Tatjana		
Lecturer/associate (for exercises)				
Lecturer/associate (for OFE)				
Number of ECTS	10	Course status (obligatory/elective)	Elective	
Prerequisites				
Course objectives	The goal of this course is to highlight the crucial development directions and new challenges during design of embedded systems including design for low power, optimization of hardware and software, SoC and MPSoC design and configurable processors.			
Course outcomes	Student's ability to design hardware and software part of embedded systems and correctly evaluate the cost-performance ratio.			
Course outline				
Theoretical teaching	Embedded versus general purpose processors. Methodologies of designing hardware and software embedded systems. Calculation models. Limitations and challenges (high reliability, high performance, low cost, low power). Hardware-software codesign. Programming and code optimization. Tools for development and testing. Embedded operating systems. Task scheduling and execution in real time. Selection and installation of the operating system. Verification. Multiprocessor architectures. Types. Homogeneous and heterogeneous multiprocessor structures. Process elements. Interconnection networks. Memory systems. Physical distribution. Design methodologies and algorithms. Multiprocessor software. Operating systems. Services and middleware. Verification of design. SoC design. The design of complex SoCs at system level. Configurable processors. Software and hardware aspects. Application specific processors. Automatic configuration of processor and instruction set. Compilers. Accelerator units. MPSoCs. Designing SoCs using cores and configurable cores. Buses and networks on chip. Operating systems for MPSoC. Testing and verification. Typical applications.			
Practical teaching (exercises, OFE, study and research)	Preparation of seminar papers in the field of application specific processor, input-output modules with specific purpose, interconnection on- and off-chip networks, and multiprocessor systems-on-chip. Evaluation of system performance in terms of operating frequency, power consumption, and the silicon area.			
Textbooks/references				
1	R. Kamal, Embedded Systems, McGraw Hill, 2008.			
2	Alan Holt, Chi-Yu Huang, Embedded Operating Systems, A Practical Approach, Springer-Verlag, 2014.			
3	William J. Dally, Curtis Harting, Digital Design: A system approach, Cambridge University Press, 2012.			
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	Teaching is held in a form of lectures and mentoring work with students. Independent and team work of students during solving tasks within research projects.			
Grade (maximum number of points 100)				
Pre-exam duties	Points	Final exam	Points	
Activity during lectures		Written exam		
Exercises		Oral exam	50	
Colloquia				
Projects	50			

