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	Embedded Systems Design		
Lecturer (for lectures)	Đošić M. Sandra		
Lecturer/associate (for exercises)	Jovanović D. Milica		
Lecturer/associate (for OFE)	Stojanović Z. Igor		
Number of ECTS 5	**Course status (obligatory/elective)**	Elective	

Prerequisites	
Course objectives	The course aims to provide students with a fundamental knowledge of methods and tools for modeling, specification, partitioning, synthesis (hardware, software and interface), validation, verification and design of embedded system.
Course outcomes	By the end of the course a student should be able to: a) model and specify embedded systems at high level of abstraction; b) analyze hardware/software tradeoffs, algorithms and architectures to optimize the embedded systems based on requirements and implementation constraints.
Course outline	
Theoretical teaching	Introduction to embedded system design: application areas and examples, common characteristics, and challenges in embedded systems; traditional design flow, platform-based design. Specifications and modeling: requirements, models of computation, communicating finite state machines, data flow models, process networks, discrete-event based languages, levels of hardware modeling; comparison of models of computation. Evaluation and validation: performance evaluation, energy and power models, simulation, emulation, formal verification. Application mapping: problem definition, scheduling in real-time systems, hardware/software partitioning, mapping to heterogeneous multi-processors.
Practical teaching (exercises, OFE, study and research work)	Practical classes cover work with the FPGA development platforms. Several laboratory exercises and small-scale projects focus on unified designing of hardware and software as well as performance evaluation. Practical classes include the following activities: a) designing a complete microprocessor based on the available IP core of standard peripheral units, b) developing software under the operating system using available device drivers, c) designing a dedicated IP core, and d) developing a software driver for the projected IP core and its integration into the microprocessor system.
Textbooks/references	
1	P. Marwedel, Embedded System Design: Foundations of Cyber-Physical Systems, and the Internet of Things, Springer, 2018.
2	M. Wolf, High-Performance Embedded Computing: Applications in Cyber-Physical Systems and Mobile Computing, Morgan Kaufmann, 2014.
3	L. H. Crockett, R. A. Elliot, M. A. Enderwitz, R. W. Stewart, The Zynq Book : Embedded Processing with the Arm Cortex-A9 on the Xilinx Zynq-7000 All Programmable SoC, Strathclyde Academic Media, 2014
4	Embedded System Design, Notes and PowerPoint presentation for all lectures, available online.
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	Lectures, exercises, labs, homework, colloquia, consultations.

Grade (maximum number of points 100)

Pre-exam duties	Points	Final exam	Points
Activity during lectures		Written exam	25
Exercises	30	Oral exam	25
Colloquia			
Projects	20		