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	Advanced Computer Architecture		
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	This course will focus on the crucial techniques for hardware and software design of high performance modern computer systems with consideration of the newest architectural innovations.		
Course outcomes	Students acquire knowledge about advanced computer architectures including modern architectural techniques of newer CPU generations, memory and input/output subsystems, as well as programming techniques. During this course the student learns how to design high performance computer systems and evaluate their performances.		
Course outline			
Theoretical teaching	Performance evaluation of computer systems: metrics, average performance, errors in estimation, tools and techniques for the estimation, benchmark programs. Overview of advanced computer architecture: pipeline, superscalar, VLIW, DSP and multimedia processors, multicore and multithread architectures. Instruction level, machine level and thread level parallelism. Chip multiprocessors. Design challenges and constraints. Memory system. Memory hierarchy. Register file. Scratch pad memory. Main memory organization. Cache hierarchy. Coherence, synchronization, memory consistency. Memory implementation concepts for mass storage. Virtual memory and paging. Input-output organization and interfaces. Programming input-output. Buses. Context switching and interruptions. Networks on chip. Topologies. Routing and switching techniques. High speed data transfer. Specific purpose processors. Application specific integrated processors. High performance energy efficient processors. Programming techniques. Simulators of computer systems. Estimation of power consumption and chip area.		
Practical teaching (exercises, OFE, study and research	Preparation of seminar papers in the field of cache memory, input-output subsystems, multiprocessor system-on-chip.		
Textbooks/references			
1	J. L. Hennessy, D. A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann, 2012.		
2	D. A. Patterson, J. L. Hennessy, Computer Organization and Design, The hardware/software interface, Elsevier Inc., 2014.		
3	Michel Dubois, Murali Annavaram, Per Stenstrom, Parallel Computer Organization and Design, 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 studets. 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		