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	DSP Algorithms and Programming		
Lecturer (for lectures)	Nikolić R. Tatjana		
Lecturer/associate (for exercises)	Nikolić R. Tatjana		
Lecturer/associate (for OFE)	Nikolić R. Tatjana		
Number of ECTS	5	**Course status (obligatory/elective)**	Elective
Prerequisites			
Course objectives	The goal of this course is to introduce students with the theoretical and practical knowledge required for implementation of the basic algorithms from the domain of digital signal processing using DSP processors.		
Course outcomes	The students are able to use DSP processor for digital signal processing using high-level programming languages and modern development tools to implement complex DSP algorithms.		
Course outline			
Theoretical teaching	Review of the theory of digital signal processing. Digitization of analog signals. Sampling, quantization and work with the codec. A/D and D/A converters. Specificity and DSP processor architectures. Representation of the data using fixed and floating point format and arithmetic; the effect of finite length words. Instruction set. Development and implementation of computationally efficient algorithms on the DSP platform: convolution, correlation, digital filters (IIR, FIR, LMS, DFT, FFT, IFFT). Audio signal processing using DSP processors. Image processing using DSP processors. Programming the DSP processors in assembly language and higher programming language. Development kits and tools: assembler, linker, simulator, debugger. Writing an efficient code: compiler optimization, effect of data types and memory map. Code optimization.		
Practical teaching (exercises, OFE, study and research work)	It is planned that students individually do the following exercises: 1) Manipulation with numbers of fixed- and floating-point format, 2) Getting to know the possibilities of modern development tools for design, 3) Implementation of FIR and IIR filters using MATLAB and FDATool, 4) Practical application of FFT, 5) Generation of sinusoidal and noise signal, DTM (dual-tone multifrequency) generator and tone detector; 6) Audio signal processing, sound source location, and application in speech recognition, 7) Echoes cancelation, 8) Techniques for channel coding and application in communications, 9) Digital image processing, histogram, filtering, application of standard JPEG and DCT, 10) Medical image processing, filtering electrocardiogram (ECG) and electroencephalogram (EEG) signals. Exercises are carried out using software tools MATLAB and Code Composer Studio, and DSP development system.		
Textbooks/references			
1	DSP algorithms and programming, Script and PowerPoint presentations for all lectures, available on the website of the course		
2	Kuo, S., Lee, B., Tian, W., Real-Time Digital Signal Processing: Fundamentals, Implementations and Applications, Second Edition, John Wiley & Sons Ltd., 2013.		
3	Kuo, S., Gan, W. S., Digital Signal Processors: Architectures, Implementations, and Applications, Pearson Educaton Inc., 2005.		
4			
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, homeworks, colloquia, projects, consultations			

Grade (maximum number of points 100)			
Pre-exam duties	**Points**	**Final exam**	**Points**
Activity during lectures		**Written exam**	20
Exercises	20	**Oral exam**	20
Colloquia	20		
Projects	20		