

## Specification for the book of courses

<b>Study program</b>		Electrical Engineering and Computer Science		
<b>Module</b>		Common		
<b>Type and level of studies</b>		Doctoral studies		
<b>The name of the course</b>		Audio Communications		
<b>Lecturer (for lectures)</b>		Ćirić G. Dejan		
<b>Lecturer/associate (for exercises)</b>				
<b>Lecturer/associate (for OFE)</b>				
<b>Number of ECTS</b>	10	<b>Course status (obligatory/elective)</b>	Elective	
<b>Prerequisites</b>				
<b>Course objectives</b>		Mastering knowledge, introduction to modern achievements and research within the field of audio communications, audio signals, analysis and synthesis of auditory scenes, audio analytics as well as audio signal processing.		
<b>Course outcomes</b>		Theoretical knowledge. Solving practical problems in the field of audio signals and systems: analysis, synthesis and design. Skills of appropriate use of audio devices and systems. Mastering the applications of modern technologies based on sound.		
<b>Course outline</b>				
<b>Theoretical teaching</b>		Audio signals (definitions, concepts). Characteristics of speech and music signals. Audio communication systems (structure and characteristics). Input and output acoustical environment (sound sources and receivers, spatial environment). Audio devices. Audio analytics. Auditory scenes (analysis and synthesis). Detection and classification of audio events. Audio signal processing. Sound synthesis. Subjective effects of sound. Spatial sound image and 3D sound. Auditory virtual environments. Audio restoration. Perceptual coding and audio compression. Sound sources separation and speech dereverberation. Analysis and processing of speech. Audio signal quality (speech quality - intelligibility). Audiometry and audiology. Hearing aids. Applications of sound based technology in medicine.		
<b>Practical teaching (exercises, OFE, study and research)</b>		Solving problems through the students' research projects from the following teaching units: audio communication systems; effects of input and output acoustical environment; auditory scenes and virtual spaces; audio signal processing; sound synthesis; subjective effects of sound; spatial sound image; audio signal quality estimation; audio event detection; audiometry and audiology.		
<b>Textbooks/references</b>				
1	Y. Huang, J. Benesty: Audio signal processing for next-generation multimedia communication systems, Kluwer Academic Publishers, Boston, 2004.			
2	M. Kahrs, K. Brandenburg: Applications of digital signal processing to audio and acoustics, Kluwer Academic Publishers, USA, 2002.			
3	A. R. Moller: Hearing: anatomy, physiology, and disorders of the auditory system, 2nd edition, Academic Press, San Diego, 2006.			
4	S. Savage: The art of digital audio recording, Oxford University Press, New York, 2011.			
5	D. Jarrett, E. Habets, P. Naylor: Theory and applications of spherical microphone array processing, Springer, Switzerland, 2017.			
<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>
3	0	0	0	0
<b>Teaching methods</b>		Lectures. Consultations. Student research 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>			<b>Written exam</b>	
<b>Exercises</b>		30	<b>Oral exam</b>	40
<b>Colloquia</b>				
<b>Projects</b>		30		