

Specification for the book of courses

Study program	Communications and Information Technologies			
Module	Communications and Information Processing			
Type and level of studies	Master studies			
The name of the course	Advanced MIMO Systems			
Lecturer (for lectures)	Milović M. Daniela			
Lecturer/associate (for exercises)	Panajotović S. Aleksandra			
Lecturer/associate (for OFE)				
Number of ECTS	4	Course status (obligatory/elective)	Elective	
Prerequisites				
Course objectives	Acquiring fundamentals of modern wideband communication systems based on MIMO technology, their performances, limits and challenges.			
Course outcomes	Upgrade previously acquired knowledge from wireless communications field through introducing with advanced MIMO systems, which are currently used in 4G, and which will undoubtedly be part of 5G. Applying presented theory in practical realization of wireless systems, will be enable through design and implementation of 4G and 5G systems in Matlab.			
Course outline				
Theoretical teaching	Introduction – advantages of multiantenna systems – spatial diversity vs. spatial multiplexing. MIMO channel. Capacity of MIMO channel. MIMO transmitter. MIMO receiver. Estimation of MIMO channel and its influence on MIMO system performance. Multiuser MIMO systems. Precoding techniques in multiuser MIMO systems. Massive MIMO.			
Practical teaching (exercises, OFE, study and research)	Solving practical problems existing in MIMO and multiuser MIMO systems on lectures. Individual research of the latest trends in multiuser and massive MIMO system through study-research work			
Textbooks/references				
1	A. Goldsmith, "Wireless Communications", Cambridge University Press, 2012.			
2	Y. S. Cho, J. Kim, W. Y. Yang, C. -G. Kang, "MIMO-OFDM Wireless Communications with MATLAB", Wiley, 2010.			
3	T. L. Marzetta, E. G. Larson, H. Yang, H. Q. Ngo, "Fundamentals of Massive MIMO", Cambridge University Press, 2016.			
4				
5				
Number of classes of active education per week during semester/trimester/year				
Lectures	Exercises	OFE	Study and research work	Other classes
2	1	0	0	0
Teaching methods	Lectures, auditory exercises homeworks, office hours.			
Grade (maximum number of points 100)				
Pre-exam duties	Points	Final exam	Points	
Activity during lectures	10	Written exam	25	
Exercises	20	Oral exam	25	
Colloquia				
Projects	20			