



## Subject card

Subject name and code	Telecommunication Signals, PG_00048115						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2026/2027		
Education level	first-cycle studies		Subject group		Optional subject group Subject group related to scientific research in the field of study		
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	3		Language of instruction		Polish		
Semester of study	5		ECTS credits		1.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Radiocommunication Systems and Networks -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Sławomir Gajewski				
	Teachers		dr inż. Sławomir Gajewski				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	15		1.0		9.0	25
Subject objectives	Learning basic properties of modulated signals and methods of telecommunications systems quality evaluation.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_U06] can analyse the operation of components, circuits and systems related to the field of study, measure their parameters and examine technical specifications		can analyse noise characteristics		[SU2] Assessment of ability to analyse information		
	[K6_W34] Knows the characteristics of telecommunications channels, methods of securing information, modulation systems, methods of access to the channel.		knows basic methods for digital and analog modulation		[SW1] Assessment of factual knowledge		
	[K6_W35] Knows the concepts of the technique of signal transmission, operation of telecommunications networks and multimedia services and the rules for providing them		knows modulating systems and their properties		[SW1] Assessment of factual knowledge		
	[K6_K02] is ready to critically assess possessed knowledge and acknowledge the importance of knowledge in solving cognitive and practical problems		student critically assesses the properties of systems from the point of view of the type of modulation		[SK5] Assessment of ability to solve problems that arise in practice		
	[K6_U05] can plan and conduct experiments related to the field of study, including computer simulations and measurements; interpret obtained results and draw conclusions		can plan noise characteristics for different modulation systems		[SU1] Assessment of task fulfilment		

Subject contents	1. Signals transmission in communication systems. Performance of transmission. Noise characteristics of communication system. 2. Fundamentals of multiple access methods. The target of modulation. Modulation with harmonic carrier and pulse carrier. Modulation gain. Temporary amplitude, phase and frequency. 3. Analog amplitude modulation. Characteristics of amplitude modulated signals, spectrum, power, frequency band of signals. Reception of signals. Comparison of different types of amplitude modulation. 4. Analog angle modulation. Characteristics of phase and frequency modulated signals, spectrum, power, frequency band. Reception of signals. Preemphasis and deemphasis. 5. Time domain characteristics of amplitude and angle modulated signals with harmonic and rectangle modulating signals. Characteristics of temporary amplitude, phase and frequency, comparisons. 6. Digital communication system, performance of transmission. Noise characteristics of digital system. 7. Digital baseband modulations. A/D conversion, quantization noise. 8. PCM modulation, companding methods, compressor and expander, noise characteristics. Time domain characteristics of PCM modulated signals. 9. Delta modulation, adaptation, noise characteristics. DPCM modulation, sigma-delta modulation. 10. Reception of binary signals transmitted over AWGN channel. Vector signals representation. Optimisation of reception – matched filter, correlating receiver. 11. Baseband transmission of digital signals. Intersymbol interference (ISI). Channel without ISI – raised cosine filter. 12. Digital modulations with harmonic carrier – ASK, FSK, PSK. Characteristics of modulated signals, spectrum, time-domain characteristics. 13. M-ary digital modulations, quadrature modulation QPSK, methods of modulated signals reception and their performance. 14. Comparison of noise characteristics for digital systems. Vector representation of signals, decision areas. 15. Noise characteristics for digital system with channel coding.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Colloquium	50.0%	100.0%
Recommended reading	Basic literature	Haykin S.: Systemy telekomunikacyjne, tom 1 i 2. WKiŁ 2004 r. (lub wydania wcześniejsze)	
	Supplementary literature	No requirements	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		