



## Subject card

Subject name and code	Telecommunication Signals, PG_00048115						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	October 2021	Academic year of realisation of subject			2023/2024		
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_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_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_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		
	[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		

Subject contents	<p>1. Signal transmission in communication systems. Performance of transmission. Noise characteristics of a communication system. 2. The term and 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. Methods for improvement of modulation characteristics. 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, the 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, and noise characteristics. 10. DPCM modulation, sigma-delta modulation. 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. The principle of QAM. 14. Comparison of noise characteristics for digital systems. Vector representation of signals, and decision areas. 15. Noise characteristics for digital systems with channel coding.</p>		
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: Sygnały telekomunikacyjne - Moodle ID: 32648 <a href="https://enauzanie.pg.edu.pl/moodle/course/view.php?id=32648">https://enauzanie.pg.edu.pl/moodle/course/view.php?id=32648</a>	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		