



Subject card

Subject name and code	Analises and Procesing of Telecommunication Signals, PG_00048156						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	October 2021		Academic year of realisation of subject		2024/2025		
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	4		Language of instruction		Polish		
Semester of study	7		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Teleinformation Networks -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Maciej Sac				
	Teachers		dr inż. Maciej Sac				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	0.0	0.0	45
	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	45		4.0		51.0	100
Subject objectives	Familiarize students with basic algorithms for digital analysis and processing of telecommunications signals and with selected aspects of the implementation of digital signal processing algorithms on digital signal processors.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W35] Knows the concepts of the technique of signal transmission, operation of telecommunications networks and multimedia services and the rules for providing them		Describes the basic diagram of a digital modulator and demodulator. Explains symbol synchronization algorithms. Describes the power density spectrum estimators. Discusses the problems of implementation of signal processing algorithms on processors with fixed point arithmetic		[SW1] Assessment of factual knowledge		
	[K6_U31] can identify telecommunications network architectures, differentiates their areas and functional elements, evaluates the quality of service delivery, calculates parameters of functional elements		Evaluates the purity of the DDS generator output signal. Interprets the eyediagram. Determines and evaluates the frequency responcees of digital filters.		[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools		

Subject contents	1. The role of signal processing in telecommunications. Overview of solutions used in a physical layer of contemporary networks. 2. Contemporary digital receiver of data transmission signal. 3. Analytic signal and Hilbert filter. 4. Quadrature sampling and undersampling of real-valued signals. 5. Sinusoidal signal generation. DDS and CFB – implementation and purity criteria for generated signal. 6. Single-parameter digital modulators. Typical constellations of symbols. Fundamental structure of digital modulator. 7. Phase keying modulation – FSK. 8. MSK and GMSK modulations. 9. Differential modulators and demodulators (DBPSK and DQPSK). 10. Offset modulators and demodulators (OQPSK and pi/4-QPSK) 11. Symbol shaping and matched filtering. 12. Shaping/interpolation and matched/decimation filters. 13. Modems with multiple constellation points - QAM 14. Carrier recovery, automatic frequency and phase synchronization. 15. Digital phase locking loop DPLL. 16. Fundamental symbol timing recovery (STR) algorithms – systems with closed loop. 17. Symbol timing signal extraction and its application to symbol sampling in open loop systems. 18. Automatic gain correction (AGC) in digital transmission. 19. Digital filters in signal analysis. 20. Specification, computation and evaluation of frequency responses of digital filters. 21. DFT in frequency analysis. Analysis of periodic signals. Relations between DTFT and DFT. Goertzel algorithm. 22. Spectral analysis of signals; spectral power density estimation. 23. Time-frequency analysis – spectrograph. 24. Signal analysis – exemplary implementations in MATLAB. 25. Presentation of analysis results – exemplary implementations in MATLAB. 26. Architecture of digital signal processors. Digital signal processors commands dedicated to signal processing. 27. Limitations of fixed-point arithmetic – effects of rounding and overflow. 28. Efficient implementation of nonlinear functions for digital signal processors. 29. Problems of digital filter implementation on fixed-point arithmetic processors. 30. Robust structures for IIR filter.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam	50.0%	45.0%
	Laboratory	50.0%	45.0%
	Activity	0.0%	10.0%
Recommended reading	Basic literature	1. R. G. Lyons: Wprowadzenie do cyfrowego przetwarzania sygnałów, WKŁ, 2010 2. Paolo Prandoni and Martin Vetterli, Signal Processing for Communications, EFPL Press, 2008 3. Steven W. Smith: The Scientist and Engineer's Guide to Digital Signal Processing, California Technical Publishing, 1997 4. Fuqin Xiong: Digital Modulation Techniques, Artech House, 2000	
	Supplementary literature	No requirements	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		