GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Analises and Procesing of Telecomunication Signals, PG_00048156		
Field of study	Electronics and Telecommunications		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2027/2028
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_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 responces of digital filters.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject
[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

<table>
<tr><td>Subject contents</td><td>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.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Activity</td><td>0.0%</td><td>10.0%</td></tr>
<tr><td>Laboratory</td><td>50.0%</td><td>45.0%</td></tr>
<tr><td>Written exam</td><td>50.0%</td><td>45.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>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</td></tr>
<tr><td>Supplementary literature</td><td>No requirements</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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