COURSE DESCRIPTION CARD

<table>
<tr><td colspan="10">Bialystok University of Technology
Faculty of Electrical Engineering</td></tr>
<tr><td>Field of study</td><td colspan="6">Erasmus</td><td>Degree level and programme type</td><td>bachelor's degree, full time programme</td></tr>
<tr><td>Specialisation/ diploma path</td><td colspan="6"></td><td>Study profile</td><td></td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">Digital signal processing</td><td>Course code</td><td>IS-FEE-10026S</td></tr>
<tr><td>Course type</td><td>elective</td></tr>
<tr><td rowspan="2">Forms and number of hours of educational activities</td><td>L</td><td>C</td><td>LC</td><td>P</td><td>SW</td><td>FW</td><td>S</td><td>Semester</td><td>summer</td></tr>
<tr><td>30</td><td></td><td>30</td><td></td><td></td><td></td><td></td><td>No. of ECTS credits</td><td>6</td></tr>
<tr><td>Entry requirements</td><td colspan="9"></td></tr>
<tr><td>Course objectives</td><td colspan="9">The aim of the course is to acquaint the students with the basics of the digital signal processing. Student is familiar and can apply methods of signal analysis in time and frequency domains. Student is able to use methods of digital filter design and is familiar with issues of digital filter analysis and implementation.</td></tr>
<tr><td>Course content</td><td colspan="9">Lecture: Areas of application of digital signal processing methods. Signal classification. Sampling of continuous time signals: the sampling theorem, anti-aliasing filter, quantization, practical aspects of A/D and D/A conversion, digital resampling. Properties and application of the Discrete Fourier Transform; Fast Fourier Transform algorithms; analysis of nonstationary signals. Z-transform: properties and application. Description methods of discrete time signals and systems: difference equation, impulse response, Z-transform, transfer function, frequency response, state space representation. Overview of digital filter analysis, synthesis and application: infinite impulse response filters, finite impulse response filters, commonly used filters, time and frequency domain parameters, windowing, linear phase filters. Stability. Linear and circular convolution. DSP implementation issues.
Laboratory classes: Sampling and quantization of continuous signals, anti-aliasing filter; properties and application of the Fast Fourier Transform; impulse response, frequency response, digital filter analysis, filter synthesis, IIR and FIR filters, linear phase filters.</td></tr>
<tr><td>Teaching methods</td><td colspan="9">lecture, problem solving, laboratory experiments</td></tr>
<tr><td>Assessment method</td><td colspan="9">lecture: written exam;
laboratory class: evaluation the student's reports and performance in classes.</td></tr>
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Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
LO1	Student is familiar with issues of sampling of continuous time signals and analysis of discrete-time signals	
LO2	Student knows description methods of digital systems and can describe methods of digital filters synthesis and analysis;	
LO3	Student performs sampling of continuous time signals and performs spectral analysis;	
LO4	Student performs design process of the basic digital filters and performs properties verification of their implementation.	

Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	exam	L
LO2	exam	L
LO3	evaluation of student's reports and performance in classes	LC
LO4	evaluation of student's reports and performance in classes	LC
LO5		
LO6		

Student workload (in hours)		No. of hours
Calculation	lecture attendance	30
	preparation for and participation in exams	35
	participation in laboratory classes	30
	preparation for laboratory classes	20
	work on reports	30
	participation in student-teacher sessions (L+LC)	5
	TOTAL:	150

Quantitative indicators	HOURS	No. of ECTS credits
Student workload – activities that require direct teacher participation	65	2.5
Student workload – practical activities	83	3

Basic references	1. Rao K., Swamy M., Digital Signal Processing. Theory and Practice, Springer, 2018. 2. Rawat T. K., Digital Signal Processing. Oxford University Press, 2015. 3. Gazi O., Understanding Digital Signal Processing. Springer, 2018. 4. Oppenheim A. V., Schafer R., Discrete-time Signal Processing. Prentice

	Hall, 2010. 5. Hussain Z. M., Sadik A. Z., Digital Signal Processing. Springer, 2011.	
Supplementary references	1. Manolakis D. G., Ingle V. K., Applied Digital Signal Processing: Theory and Practice. Cambridge University Press, 2011. 2. Thyagarajan K.S., Introduction to Digital Signal Processing Using MATLAB with Application to Digital Communications, Springer, 2019. 3. Smith S. K., Digital Signal Processing; A Practical Guide for Engineers and Scientists. Elsevier Science, 2003. 4. Parker, Michael. Digital Signal Processing 101: Everything You Need to Know to Get Started, Elsevier Science & Technology, 2017. 5. Downey A. B., Think DSP: Digital Signal Processing in Python, O'Reilly, 2016.	
Organisational unit conducting the course	Department of Photonics, Electronics and Lighting Technology	Date of issuing the programme
Author of the programme	Dariusz Jańczak, PhD, DSc	23.02.2024

L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work, S – seminar