COURSE DESCRIPTION CARD - SYLLABUS

Course name
Theory of the discrete signals [S1MNT1>J-TSD]

Course

Field of study
Mathematics of Modern Technologies

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Knowledge of mathematical analysis, complex numbers and probability. The concept of a signal as an infor- mation carrier. Knowledge of the binary number system. Knowledge of the basics of measurement technology. Using algebra of complex numbers. Understanding the need for education and systematization of knowledge in the field of information processing.

Course objective

Gaining knowledge in the field of mathematical description and practical implementation of selected methods of one- and two-dimensional discrete signal processing.

Course-related learning outcomes

Knowledge:
• knows and understands issues in the field of technical sciences, including automation, robotics, electrical engineering and electronics to a sufficient degree [K_W04(P6S_WG)];
• knowsandunderstandstherelationshipbetweenmathematicsandmoderntechnologies[K_W05(P6S_WG)];
• knows and understands the techniques of measurement, acquisition, processing and analysis of data or signals to an advanced degree [K_W08(P6S_WG)].

Skills:
• can use mathematical tools to support and develop modern technologies used in engineering and technical sciences [K_U06(P6S_UW)];
• can choose the appropriate method and use measuring equipment to measure basic measurable quantities; can use the basic methods of processing and analyzing data or signals [K_U09(P6S_UW)];
• can use the acquired knowledge and appropriate methods and tools to solve typical engineering tasks [K_U12(P6S_UW)].

Social competences:
• is ready to deepen and expand knowledge to solve new technical problems [K_K02(P6S_KK)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures: currently estimating of student activity. Final exam in form of a test in writing (passing over 50%);
Laboratory classes: current estimating of knowledge and skills. Evaluation of prepared reports from laboratories.

Programme content

Acquisition of measurement data. Limitations and effects of signal discretization and quantization. Selected sample collection formats. Time and frequency representation of a discrete signal. Calculation of selected parameters and functions based on a series of samples. Properties of discrete LTI systems and their use for signal processing. Design of discrete NOI and SOI filters and implementation of discrete filtration. Discrete convolution in the time and frequency domain. Computational algorithms and interpretation of discrete Fourier transform results. Configuration of the image acquisition path. Selected graphic file formats. Linear and nonlinear methods of image processing and improvement. Image histogram and its application.

Course topics

Update:20.06.2024
Lectures:
• the definition of single dimensional and two dimensional discrete signal;
• the block diagram of acquisitions system of discrete signals;
• theorem of sampling;
• saving signal samples in computer memory as a data file;
• evaluate of selected parameters of data set;
• the description of discrete LTI systems in a time domain and also a frequency domain;
• the impulse response of discrete LTI system;
• design of FIR and IIR filters;
• the discrete convolution in a time domain and a frequency domain;
• the interpretation of DFT;
• the selected transforms of discrete signals and their interpretation;
• Adaptive filtration;
• the block diagram of imaging system;
• the acquiring and sampling of image;
• histogram of image and its application;
• selected linear and non-linear methods of processing of images.
Laboratory classes:
• sampling and quantization of signal;
• comparing of analog and digital filter;
• implementation of selected algorithms of discrette signals processing.

Teaching methods

Lectures: multimedia presentations expanded by examples shown on a board; activity of students is taken into consideration in final students evaluation; theoretical questions are presented in the exact reference

to the practice;
Laboratory classes: detailed reviewing of particular exercises reports; realization of laboratory tasks in teams; realization of interesting experiments in scope digital signal processing; using tools to enable students to work from home; methods of education are orientated to students to motivate them to participate actively in education process by discussion and reports.

Bibliography

Basic:
• Zieliński T., Cyfrowe przetwarzanie sygnałów. Od teorii do zastosowań. WKiŁ, Warszawa 2014;
• Lyons R.G., Wprowadzenie do cyfrowego przetwarzania sygnałów, WKiŁ, Warszawa 2010.

Additional:
• Szabatin J., Teoria sygnałów. WKiŁ., Warszawa 2015;
• Stranneby D., Cyfrowe przetwarzanie sygnałów, Wyd. BTC, Warszawa 2004.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	47	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	53	2,00