COURSE DESCRIPTION CARD - SYLLABUS

Course name
Selected problems of signal processing [N2Eltech2>WZPS]

Course

Field of study
Electrical Engineering

Year/Semester
2/3

Area of study (specialization)
Electrical Systems in Industry and Vehicles

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
10

Laboratory classes
10

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

dr hab. inż. Michał Gwóźdź prof. PP
michal.gwozdz@put.poznan.pl

mgr inż. Mariusz Świderski
mariusz.swiderski@put.poznan.pl

Lecturers

Prerequisites

The student starting this course should have basic knowledge of the basics of programming, telecommunications and mathematics. He should also have the ability to obtain information from the indicated sources and be ready to cooperate as part of the team.

Course objective

Provide students with basic knowledge of the properties and principles of signal analysis in the time and frequency domain, analysis and design of digital filters, especially in the aspect of discrete closed systems.

Course-related learning outcomes

Knowledge:
1. Has knowledge of development trends, new achievements and dilemmas of modern engineering.

Skills:

1. Can obtain information from literature, databases and other sources, make their interpretation, evaluation, critical analysis and synthesis, as well as draw conclusions and formulate and exhaustively justify opinions.
2. Can formulate and test hypotheses related to engineering and simple research problems, develop detailed documentation of the results of the experiment, design tasks, interpret the obtained results and draw conclusions.

Social competences:
1. Recognizes the importance of knowledge in solving cognitive and practical problems and understands that in technology, knowledge and skills quickly become obsolete and therefore require constant replenishment.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during the lecture is verified by one 45-minute test carried out during the last lecture. The test consists of 15-20 questions (test and open-ended), with different scores. Passing threshold: 50% of points. Final issues, on the basis of which the questions are developed, will be sent to students by e-mail using the university's e-mail system.
The skills acquired during the laboratory classes are verified on the basis of a final test, consisting of 5-7 tasks with different scores depending on the degree of their difficulty, and on the basis of reports from the laboratory classes. Passing threshold: 50% of points.

Programme content

Classification of signal properties. Signal space. Signal approximations. Representation of signals using Fourier formulas. Analog signal processors. Fourier series. Frequency domain analysis. Feedback systems and their transmittances. Nyquist and Bode plots. Sampling and discrete signals. Discrete Fourier transform. Discreet models. Difference equations. Z transformation. Inverse z transformation. Application of digital filtering and impulse control. Digital filters. SOI filters. NOI filters.

Course topics

Issues carried out during the lecture: Systems and signals. Classification of signal properties. Introduction to the problem of signal space. Signal approximations. Representation of signals using Fourier's formulas. Stationary linear systems. Time domain analysis. Analog signal processors. Weave. Peculiar functions: impulses and jumps. Impulse response. Transmittances. Band spectra and spectral transmittance. Fourier series. Frequency domain analysis. Fourier transforms and spectra continuously. Time and frequency pulses. Circuits with feedback and their transfer functions. Analysis of frequency characteristics. Nyquist and Bode charts. Sampling and discrete signals. Discrete Fourier transform. Discrete models. Difference equations. Z transform. Inverse transform. Application of digital filtering and impulse control. Linear discrete systems. Impulse response. Transmittance. The causality and stability of digital circuits. Digital filters. SOI filters. NOI filters. Design issues of digital filters.
Problems carried out during the laboratory: Determining the basic parameters of signals. Processing and reconstruction of signals. Fourier transformation. Digital simulation of analogue circuits - Z transformation. Digital filters. Analog and digital modulation.

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples given on the blackboard.
2. Laboratory exercises: a multimedia presentation, a presentation illustrated with examples given on the blackboard and carrying out the tasks given by the teacher - practical exercises.

Bibliography

Basic:
Zieliński T.P., Cyfrowe przetwarzanie sygnałów. Od teorii do zastosowań, Wydawnictwa Komunikacji i Łączności, Warszawa 2009.
Smith S.W., The Scientist and Engineer's Guide to Digital Signal Processing, California Technical Publishing, San Diego 1999.
Stranneby D., Digital Signal Processing: DSP and Applications, Elsevier Inc, Burlington 2001.

Lyons R.G., Wprowadzenie do cyfrowego przetwarzania sygnałów, Wydawnictwa Komunikacji i Łączności, Warszawa 1999.
Oppenheim V, Schaffer R.W., Cyfrowe przetwarzanie sygnałów, WKŁ, Warszawa 1979.
Izydorczyk J. i inni, Matlab i podstawy telekomunikacji, Wydawnictwo Helion, 2017.
Mrozek B., Mrozek Z., MATLAB i Simulink. Poradnik użytkownika. Wydanie IV, Wydawnictwo Helion, 2017.
Materiały edukacyjne Mathworks: https://www.mathworks.com/

Additional:
Fitz M. P., Fundamentals of Communications Systems, 2007, McGraw-Hill
Hsu Hwei P., Schaum's Outlines of Theory and Problems of Signals and Systems, 1995, McGraw-Hill
Stewart Robert W., Barlee Kenneth W., Dale S.W. Atkinson, and Crockett Louise H., Software Defined Radio using MATLAB & Simulink and the RTL-SDR, Strathclyde Academic Media, 2015
MathWorks, FM Stereo Receiver with USRP® Hardware, dostępny 14/12/2019
M. Krystkowiak, M. Świderski, Cyfrowy sterownik rozproszony funkcjonujący w ramach Internet of Things, Poznan University of Technology Academic Journals. Electrical Engineering - 2016, Issue 88, s. 165-174
M.Świderski, A. Gulczyński, J. Biernacki, Minimization of magnetoacoustic resonant tags for the electronic article surveillance system, ITM Web of Conferences - 2019, vol. 28, s. 01032-1-01032-2

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	20	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00