COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamentals of electrical of signals processing [S1MNT1>I-PEPS]

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
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of algebra and mathematical analysis, electrical engineering and basic knowledge of electronic analog circuits and digital techniques. Proper selection of electronic components and layout design for the implementation of a simple electronic engineering task. He is aware of the need to broaden his/ her competence and shows willingness to cooperate within the team and ability to meet the requirements of participation in the didactic process realized by the university.

Course objective

Learn about the characteristics and application possibilities of analog, digital-to-analog and digital-analogconverters. Learn about modern measurement signal processing techniques.

Course-related learning outcomes

Knowledge:
• hasstructuredknowledgeaboutclassificationofbasicanalog,digital-to-analoganddigital-analogconverters

and methods of electrical signal processing - [K_W04(P6S_WG), K_W05(P6S_WG)];
• can explain electronic techniques of signal acquisition and processing for industrial applications - [K_W09(P6S_WG)].

Skills:
• can design and implement signal processing for simple measurement engineering applications and-diagnose the cause of technical malfunction [K_U06(P6S_UW), K_U07(P6S_UW)];
• can design and run an electronic system for simple measurement engineering applications and diagnose the causes of its technical failure [K_U09(P6S_UW)];
• he/sheisabletoworkaloneandinteamfortheproperselectionoftoolsforsignalprocessingtasksand to properly evaluate non-technical aspects such as time and cost of installation [K_U11(P6S_UW)].

Social competences:
• ability to think and act in a responsible and entrepreneurial manner in the area of electronic signal [K_K03(P6S_KO)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures: evaluation of knowledge and skills demonstrated on a written test and calculus nature (the written test sheet contains the information necessary to perform calculus tasks). Threshold for passing the test 50%
Laboratory classes: rewarding grades from laboratory classes as well as presence and activity during the lecture; laboratory; entry tests and rewarding knowledge necessary to implement problems posed in the area of laboratory tasks. Assessment of skills related to implementation of measurement task. Assessment of reports on the exercises performed. Assessment of knowledge demonstrated on the written test in laboratory classes (test questions and calculation tasks).

Programme content

Update: 01.06.2023r.
Lectures: the use of operational amplifiers for the implementation of analog signal converters. Analog converters of electrical signals (voltage to voltage, voltage to current, current to voltage, peak value detectors, rms value, sample and hold). Voltage-frequency and frequency-voltage converters. D/A converters: parameters, components and types of D/A converters. Analog-to-digital voltage converters: parameters, components and processing methods. Experimental tests of selected transducers;
Laboratory classes: laboratoryexercisescarriedoutduring90minutesingroupsof4.Theintroductoryclasses present safety rules, regulations and criteria for passing the laboratory. Next, the laboratory program and measuring apparatus used during the exercises are discussed. The performed laboratory tasks were divided into two parts. The first part contains exercises regarding: current-voltage and voltagecurrent converters, peak value detectors, RMS converters, voltage-frequency and frequency-voltage converters, and various types of analog-to-digital and digital-to-analog converters. In the second part, the project of electronic circuit processing signals coming from selected different types of measuring sensors is being implemented. Each group correctly assembles the electronic system and then tests its parameters and properties.

Course topics

The subject describes electronic circuits used for the conversion of analogue signals, e.g. current-voltage, voltage-frequency, rms, etc. Their operation is practically verified and their most important parameters and performance characteristics are determined.

Teaching methods

Lectures: methods of education are orientated to students to motivate them to participate actively in education process by discussion and reports; 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: laboratory realization of laboratory tasks in teams, taking into account the specific computational.

Bibliography

Basic:
• Z. Kulka, A. Libura, M. Nadachowski, Przetworniki analogowo-cyfrowe i cyfrowo-analogowe, WKŁ, Warszawa 1987;
• U. Tietze, Ch. Schenk, Układy półprzewodnikowe, WNT, Warszawa 2009;
• J. Zakrzewski, Czujniki i przetworniki pomiarowe, Wyd. Politechniki Slaskiej, Gliwice 2004;
• Z. Kulka, M. Nadachowski, Wzmacniacze operacyjne i ich zastosowania cz. 1 i 2 WNT 1983;
• J. Rydzewski, Pomiary oscyloskopowe, WNT, Warszawa, 2007.

Additional:
• J. Jakubiec, J. Roj, Pomiarowe przetwarzanie próbkujące, wyd. Politechniki Śląskiej, Gliwice 2000;
• Denton J. Dailey, Electronic Devices and Circuits, copyright 2001 by Prentice-Hall, Inc., Upper Sadle River, New Jersey 07548, USA. Warszawa 2002;
• Bibliografia wyszukana przez studenta ze zródeł drukowanych i elektronicznych W. Kester, Przetworniki A/C i C/A: teoria i praktyka, BTC, 2012;
• W.E. Ciążynski, Rzeczywiste wzmacniacze operacyjne w zastosowaniach, Wyd. PŚ, Gliwice, 2012;
• B. Carter, R. Mancini, Wzmacniacze operacyjne: teoria i praktyka, BTC, 2011;
• Ch. Kitchin, L. Counts, Wzmacniacze operacyjne i pomiarowe: przewodnik projektanta, BTC, 2009;
• Z. Nawrocki, Wzmacniacze operacyjne i przetworniki pomiarowe, Wyd. PWr, Wrocław, 2008;
• R.A. Pease, Projektowanie układów analogowych: poradnik praktyczny, BTC, Warszawa, 2005;
• L. Hasse, Zakłócenia w aparaturze elektronicznej, Radioelektronik, Warszawa,1995;
• Aviation Electronics Technician - Basic, NAVEDTRA 14028, 2003;
• Www.electropedia.org;
• J. Jakubiec, J. Roj, Pomiarowe przetwarzanie próbkujące, wyd. Politechniki Śląskiej, Gliwice 2000.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	62	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	63	2,50