FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Algorytmy cyfrowego przetwarzania sygnałów do oceny jakości energii**
Name in English:	**Digital Signal Processing Algorithm for power quality**
Main field of study (if applicable):	**Electrical Engineering**
Specialization (if applicable):	**Renewable Energy Sources**
Level and form of studies:	**2nd level, full-time**
Kind of subject:	**optional**
Subject code:	**ELR051318**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	15		15		
Number of hours of total student workload (CNPS):	30		30		
Form of crediting:	crediting with grade		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	1		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	0.70		0.70		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The mathematical knowledge of Laplace and Fourier transforms.
2. The basic ability to programming in C and Matlab.

SUBJECT OBJECTIVES

C1. Understanding and applying issues of digital signal processing.
C2. Analysis of digital systems in time and frequency domain.
C3. The use of IT tools for design and simulation of digital signal processing systems.
C4. Getting the ability to work in a laboratory group, the division of tasks and responsibilities.

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01 He has ordered knowledge of digital signal processing.
PEU_W02 He can describe and explain issues of sampling theory and analysis of discrete systems in the time domain and frequency.

relating to skills:

PEU_U01 Able to be used mathematical tools in programming environments for the description and analysis of digital signal processing problems.
PEU_U02 Able to design and implement the correct algorithms for digital signal processor.

relating to social competences:

PEU_K01 Has a aware of the responsibility for their own work in a group, realizes the rules teamwork.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Discrete-time systems, LTI systems properties, models of systems, difference equations, impulse response, systems classification signals, modeling of discrete-time signals.	2
Lec 2	Analog-to-digital conversion, periodic sampling, examples, sampling theorem, aliasing.	2
Lec 3	The z-transform, definition of the z-transform, basic properties. The inverse z-transform, using z-transform, transform analysis of systems, solving difference equations, system function.	2
Lec 4	The discrete Fourier transform (DFT), frequency spectrum. The inverse discrete Fourier transform (IDFT), Fast Fourier Transform algorithm (FFT).	2
Lec 5	FIR filters, linear phase FIR design using windows, properties, design procedures, examples.	2
Lec 6	IIR filters, introduction, structures for IIR filters, IIR filters design, impulse-invariant transformation, bilinear transformation.	2
Lec 7	Basic signal processing methods for evaluation signals parameters.	2
Lec 8	Test.	1
	Total hours:	**15**

Form of classes - laboratory		**Number of hours:**
Lab 1	Discrete-time signals and systems, analog-to-digital conversion.	2
Lab 2	Convolution, aliasing.	2
Lab 3	The z-transform, notations.	2
Lab 4	Signals and systems analysis in z-transform domain, characteristics, block diagrams.	2
Lab 5	Spectral analysis.	2
Lab 6	Parameters of discrete Fourier transform.	2
Lab 7	Digital filters, introduction, filters design, filters comparison.	2
Lab 8	Evaluation of the laboratory reports.	1
	Total hours:	**15**

TEACHING TOOLS USED
N1. Lecture with multimedia techniques.
N2. Laboratory using computer equipment.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(W)	PEU_W01 PEU_W02	Written test
P(W)	P=F1	
F1(L)	PEU_U01 PEU_U02 PEU_K01	Evaluation of the laboratory reports.
P(L)	P=F1	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] T. P. Zieliński „Cyfrowe przetwarzanie sygnałów”, 2005
[2] A. V. Oppenheim, R. W. Schafer „Cyfrowe przetwarzanie sygnałów“ 1989
[3] R. G. Lyons „Wprowadzenie do cyfrowego przetwarzania sygnałów” 1999

SECONDARY LITERATURE:

[1] G. Marven, G. Ewers „Zarys cyfrowego przetwarzania sygnałów” 1999
[2] W. Brodziewicz, K. Jaszczak „Cyfrowe przetwarzanie sygnałów” 1987
[3] R. Gabel, R. Roberts „Sygnały i systemy liniowe” 1978
[4] K. Steiglitz „Wstęp do systemów dyskretnych” 1977
[5] A. Papoulis „Obwody i układy” 1988

SUBJECT SUPERVISOR

Jacek Rezmer, jacek.rezmer@pwr.edu.pl