STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Digital Signal Processing**		Code **1010802111010832930**
Field of study **Electronics and Telecommunications**	Profile of study (general academic, practical) **general academic**	Year /Semester **1 / 1**
Elective path/specialty **Information and Communication**	Subject offered in: **English**	Course (compulsory, elective) **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **2** Classes: **-** Laboratory: **2** Project/seminars: **-**		No. of credits **5**
Status of the course in the study program (Basic, major, other) **major**	(university-wide, from another field) **university-wide**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **5 100%** **5 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Has a systematic knowledge of mathematical analysis, algebra and theory of probability - K1 _ W01 Has a systematic knowledge, together with necessary mathematical background, of 1D signal theory; this knowledge allows him/her to understand the representation of signals and signal analysis in time domain and frequency domain - K1_W06
2	**Skills**	Is able to extract information from Polish or English language literature, databases and other sources. Is able to synthesize gathered information, draw conclusions, and justify opinions - K1_U01 Is capable of studying autonomously - K1_U05 Is able to use known mathematical analysis, algebra and theory of probability concepts to solve basic problems in electronics and telecommunication - K1_U07 Demonstrates the ability to solve problems related to signal analysis in time domain and frequency - K1_U10
3	**Social competencies**	Is aware of the limitations of his/her current knowledge and skills; is committed to further self-study - K1_K01 Demonstrates responsibility and professionalism in solving technical problems. Is able to participate in collaborative projects - K1_K02

Assumptions and objectives of the course:

Learning theoretical and practical digital signal processing basics, i.e. analysis and design of linear time invariant systems, and digital spectrum analysis (through discrete Fourier transform).

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Has a systematic knowledge, together with necessary mathematical background, of basic digital signal processing methods - [K1_W19]

Skills:

1. Is able to determine basic parameters and properties of signals and telecommunication systems, under predefined constraints - [K1_U15]
2. Is able to perform typical calculations and use appropriate software to design and analyze the operation of digital signal processing systems - [K1_U18]

Social competencies:

1. Is aware of the limitations of his/her current knowledge and skills; is committed to further self-study - [K1_K01]
2. Demonstrates responsibility and professionalism in solving technical problems. Is able to participate in collaborative projects - [K1_K02]

Assessment methods of study outcomes

Final exam following lectures - short written answers to 10 questions covering the whole lecture program

Laboratory reports

Knowledge testing on the fly during laboratories (entrance or final tests, knowledge checking during lab exercises)

Course description

Signal sampling and discretization. Linear systems, time invariance, stability, causality, convolution and impulse response. Differnce equations and filters. z-Transform: definition, application to difference equations, convergence, computing of inverse z-transform. Fourier transform: discrete time Fourier transform (DTFT) and discrete Fourier transform (DFT), their relations to continuous Fourier transform, and Fourier series, and z-transform, hence, their properties. Structures of digital filters, their susceptibility to rounding errors. Design of infinite impulse response filters: starting point - analog filters, bilinear transform and invariant impulse response method, frequency transformations. Design of finite impulse response filters: Gibbs effect, linear phase filters, window method design, equiripple filters, frequency sampling method. Computation of the discrete Fourier transform: FFT, its use in fast convolution and correlation computation, note on DCT. Non-parametric methods of spectrum computation: theoretical background, averaging and smoothing of periodograms.

Basic bibliography:

1. Digital Signal Processing , J.G. Proakis, D.G. Manolakis, Pearson ? Prentice - Hall

Additional bibliography:

1. T. Zieliński, "Cyfrowe Przetwarzanie Sygnałów, od teorii do zastosowań", WKŁ, 2005.

Result of average student's workload

Activity	Time (working hours)
1. Lectures	30
2. Preparation to exam	30
3. Exam	2
4. Lab exercises	30
5. Preparation to laboratory exercises	15
6. Elaboration of lab reports	15
7. Consultations	3

Student's workload

Source of workload	hours	ECTS
Total workload	125	5
Contact hours	65	3
Practical activities	60	2