STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Advanced techniques of digital signal processing		**1010803141010834610**
Field of study: **Communications Technologies**	Profile of study (general academic, practical): **general academic**	Year /Semester: **2 / 4**
Elective path/specialty: **-**	Subject offered in: **Polish**	Course (compulsory, elective): **elective**
Cycle of study: **Doctoral studies**	Form of study (full-time,part-time): **full-time**	
No. of hours: Lecture: **15** Classes: **-** Laboratory: **-** Project/seminars: **-**		No. of credits: **2**
Status of the course in the study program (Basic, major, other): **basic**	(university-wide, from another field): **from field**	
Education areas and fields of science and art: **technical sciences** **Technical sciences**		ECTS distribution (number and %): **2 100%** **2 100%**

Responsible for subject / lecturer:

prof. dr hab. inż. Ryszard Stasiński, prof. nadzw.
email: rstasins@et.put.poznan.pl
tel. +48 61 665 3839
Wydział Elektroniki i Telekomunikacji
ul. Piotrowo 3A 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	UD-W01 Advanced-level knowledge of general nature about the domain related to the research area under study, including recent scientific achievements, and of specific nature corresponding to the research area under study, including recent scientific achievements
2	**Skills**	UD-U01 Skills connected with the methods and methodology of scientific research, including the application of methods of synthesis and evaluation required for solving research problems and innovation-related problems, as well as for the expansion and critical examination of the current state of the art and its practical application
3	**Social competencies**	UD-K01 Social competences related to the scientific, research and social roles of a scientist

Assumptions and objectives of the course:

Embracing of extended knowledge from the domain of advanced techniques of digital signal processing, i.e. analysis and design of time-variant (adaptive) systems, multirate systems, and advanced methods of spectrum estimation, including nonlinear methods.

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

Knowledge:

1. Advanced-level knowledge of general nature in the scope defined by the PhD thesis being written, as well as indepth knowledge of related subjects - [SD_W01]

Skills:

1. Ability to efficiently obtain information connected with scientific activity from various sources, and proper selection and interpretation of such information - [SD_U01]

Social competencies:

1. Self-criticism in creative work, recognition and appreciation of the need for continuous improvement of professional competences - [SD_K01]

Assessment methods of study outcomes

Verification of knowledge during lectures

Course description

Advanced techniques of identification and modeling: least squares solution (LS) for AR, MA i ARMA models, numerical methods used in LS techniques, multichannel systems. Multirate systems: idea, interpolator and decimator, polyphase structures, exact and approximate solutions of signal rate changing, multiplierless modulation and demodulation, filter banks - uniform, critically sampled, perfect and near perfect reconstructing, QMF filters, time-frequency analysis - spectrogram, Gabora transform, wavelet transforms. Advanced methods of spectrum estimation: non-parametric methods (extension), parametric methods - Yule-Walker, Burg and unconstrained AR approaches, method based on eigenvector analysis - Pisarenko method, MUSIC and ESPRIT. Nonlinear signal analysis - higher order moments and spectra, their estimation, exempalry applications.

Basic bibliography:

1. J.G. Proakis, D.G. Manolakis, "Digital Signal Processing, Principles, Algorithms, and Applications", 4 ed., Prentice Hall, 2007.

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	15
2. Preparation to lectures	25
3. Consultations	5

Student's workload

Source of workload	hours	ECTS
Total workload	45	2
Contact hours	18	1
Practical activities	25	1