

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Advanced techniques of digital signal processing		Code 1010803151010834610
Field of study Communications Technologies	Profile of study (general academic, practical) general academic	Year /Semester 3 / 5
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		
<p>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, exempalny applications.</p>		
<p>Basic bibliography:</p> <p>1. J.G. Proakis, D.G. Manolakis, &#34;Digital Signal Processing, Principles, Algorithms, and Applications&#34;, 4 ed., Prentice Hall, 2007.</p>		
<p>Additional bibliography:</p> <p>1. T. Ziełiński, &#34;Cyfrowe Przetwarzanie Sygnałów, od teorii do zastosowań&#34;, WKŁ, 2005.</p>		
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