

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Advanced signal processing algorithm		Code 1010812121010832262
Field of study Electronics and Telecommunications	Profile of study (general academic, practical) general academic	Year /Semester 1 / 2
Elective path/specialty Radio Communications	Subject offered in: Polish	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: 2 Laboratory: - Project/seminars: -		No. of credits 5
Status of the course in the study program (Basic, major, other) other		(university-wide, from another field) from field
Education areas and fields of science and art technical sciences Technical sciences		ECTS distribution (number and %) 5 100% 5 100%
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	Has extended, in-depth knowledge of those branches of mathematics which are used in formulating and solving problems in electronic and telecommunications - K2_W00 Is conversant with numerical methods used in electronics and telecommunication - K2_W07
2	Skills	Is able to select adequate numerical methods and simulation methods to solve typical tasks related to analysis, design and optimization of systems and computational tasks in telecommunication - K2_U09
3	Social competencies	Is aware of the limitations of his/her current knowledge and skills; is committed to lifelong learning - K2_K04
Assumptions and objectives of the course: Learning of theoretical and practical knowledge linked with advanced digital signal processing techniques, e.g. design and analysis of time-variant systems (adaptive), multirate systems, and advanced methods of spectral analysis.		
Study outcomes and reference to the educational results for a field of study		
Knowledge:		
1. Has a systematic, detailed knowledge, together with necessary mathematical background, of advanced methods of digital signal processing - [K2_W09]		
Skills:		
1. Is able to make typical calculations and use appropriate software to design and analyze the operation of advanced digital signal processing circuits - [K2_U12]		
2. Is able to design, construct, program and test complex, technologically advanced electronic circuits and systems, especially for telecommunication devices and systems and networks - [K2_U15]		
Social competencies:		
1. Is aware of the limitations of his/her current knowledge and skills; is committed to lifelong learning - [K2_K04]		
2. Is aware of the necessity to approach solving technical problems with responsibility and professionalism - [K2_K05]		
Assessment methods of study outcomes		
Final exam following lectures - written answers to 10 questions covering lecture material		
Colloquia during exercise classes, two - solution of few exercises		
Knowledge verification on the fly during classes		

Course description		
<p>Prediction: Wold model, ARMA, AR and MA models, linear predictor, lattice structure, normal equations, Levinson-Durbin and Schur algorithms, Wiener FIR and IIR filters. Identification and modeling: least-squares (LS) solutions for AR, MA and ARMA models. Adaptive filters: applications, gradient filters - LMS and its analysis, recursive LS filters (RLS) - Kalman filter, its improvements, various versions of fast RLS algorithms. Multirate systems: idea, interpolator and decimator, polyphase structures, exact and approximate solutions to sampling rate conversion, multiplierless modulation and demodulation, filter banks - uniform, critically sampled, perfectly and nearly-perfectly reconstructing, QMF filters, time-frequency analysis - spectrogram, Gabor transformation, wavelet transforms. Advanced methods of spectrum estimation: non-parametric methods (extension), parametric methods - Yule-Walker, Burg and unconstrained AR methods, methods based on eigenvector analysis - Pisarenko approach, MUSIC and ESPRIT.</p>		
<p>Basic bibliography: 1. T. Zieliński, "Cyfrowe przetwarzanie sygnałów, od teorii do zastosowań", WKŁ 2005.</p>		
<p>Additional bibliography: 1. J.G. Proakis, D.G. Manolakis, "Digital Signal Processing, Principles, Algorithms, and Applications", 4 ed., Prentice Hall, 2007.</p>		
Result of average student's workload		
Activity	Time (working hours)	
1. Lectures	30	
2. Preparation to exam	40	
3. Exam	2	
4. Classes	30	
5. Preparation to classes	20	
6. Preparation to colloquia	15	
7. Consultations	3	
Student's workload		
Source of workload	hours	ECTS
Total workload	125	5
Contact hours	65	3
Practical activities	65	3