

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Selected branches of mathematics II		Code 1010331221010345154
Field of study Automatic Control and Robotics	Profile of study (general academic, practical) (brak)	Year /Semester 1 / 2
Elective path/specialty -	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: First-cycle studies	Form of study (full-time, part-time) full-time	
No. of hours Lecture: 15 Classes: 15 Laboratory: - Project/seminars: -		No. of credits 2
Status of the course in the study program (Basic, major, other) (brak)		(university-wide, from another field) (brak)
Education areas and fields of science and art		ECTS distribution (number and %)
Responsible for subject / lecturer: dr Andrzej Maćkiewicz email: andrzej.mackiewicz@put.poznan.pl tel. 61 665 2805 Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznań		
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	-Knowledge of mathematical analysis and linear algebra (basic courses). Basic trigonometry and complex variables (Euler formula). Computer programming programming (high level languages like MATLAB).
2	Skills	-Can obtain information from the literature, databases, and other sources; has skills of self-learning in order to raise and update professional competence. Can work individually and in a team; know how to estimate the time required for the job; commissioned can develop and implement work schedule to ensure compliance with the terms. English language (B2 level at least).
3	Social competencies	Understands the need for continuous training opportunities-and for the improving of professional competence, (personal and social), can inspire and organize the learning of others.
Assumptions and objectives of the course: -The aim of the course is to familiarize the students with the effective techniques for solving large computational linear algebra problems. Such tasks appear in a natural way in the signal processing, mathematical statistics, optimization and numerical methods of solving differential equations. Lectures highlight the importance of orthogonality and is illustrated by ready-to-use computer programs (with an overview of their complexity and stability).		
Study outcomes and reference to the educational results for a field of study		
Knowledge:		
1. . Has a structured knowledge on selected algorithms of numerical linear algebra and approximation theory and is familiar with and data structures and methodology of procedural and object oriented programming techniques. - [K_W10:] - [-]		
2. . Has a structured knowledge on digital signal processing, information theory and is familiar with the methods of signal processing in the time and frequency domain. - [K_W05:] - [-]		
3. Has an elementary knowledge of the protection of intellectual property and patent law. - [-] - [-]		
Skills:		
1. Can construct algorithms for solving simple engineering problems and can implement, test, and run them in the PC environment (under selected operating systems). - [K_U10:] - [-]		
2. Can construct an engineering algorithm for solving simple measurement and optimal control problem, implement, test, and run it in the microprocesor environment,. - [K_U11:] - [-]		
3. Can use basic digital signal processing methods supported by statistical data analysis (in time and frequency domain), and can extract from the analysed signals the valuable information. - [K_U19:] - [-]		
Social competencies:		
1. . She/He can think and act in an entrepreneurial way. - [K_K05:] - [-]		

Assessment methods of study outcomes		
-Solving problems and writing computer programs to illustrate ideas presented during the theoretical lectures. The final Colloquium includes material of the entire semester.		
Course description		
-Geometry of the Euclidean n-dimensional space. Orthogonality (of vectors, matrices, functions) and its significance. Orthogonal projections. The best approximation theorem, Fourier coefficients. Trigonometric and polynomial interpolation, the best discrete linear least squares approximation, Convolution theorem, Gram-Schmidt Algorithm. The Fourier matrix and its properties, circular matrices, Toeplitz matrices, Recursive and iterative FFT algorithms, other trigonometric transforms (with applications to the MP4 and JPEG formats). File compression. Error-correcting codes. Encryption and secret-sharing.		
Basic bibliography:		
1. A. Maćkiewicz, Algorithms of Linear Algebra, PP, Poznań 2002 (and the enhanced manuscript of the 2nd. Ed.).		
2. L. Trefethen, Approximation Theory and Approximation Practice, SIAM, Philadelphia, 2013.		
3. P. N. Klein, Coding the Matrix, Newtonian Press 2013.		
Additional bibliography:		
1. Ch. Van Loan, Computational Frameworks for the Fast Fourier Transform, SIAM, Philadelphia, 1998.		
2. G. Strang, Linear Algebra and Its Applications, Thomson Brooks/Cole, Belmont, 2006.		
Result of average student's workload		
Activity	Time (working hours)	
Student's workload		
Source of workload	hours	ECTS
Total workload	100	2
Contact hours	45	2
Practical activities	40	1