STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Selected branches of mathematics II		**1010331121010345154**
Field of study: **Control Engineering 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: **1** Classes: **1** 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: **technical sciences**		ECTS distribution (number and %): **2 100%**

Responsible for subject / lecturer:

Dr Andrzej Maćkiewicz
email: andrzej.mackiewicz@put.poznan.pl
tel. 61 665 2805
Electrical engineering Dept.
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).
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.
Basic bibliography:
1. A. Maćkiewicz, Algorithms of Linear Algebra, PP, Poznań 2002 (and the enhanced manuscript of the 2nd. Ed.).
2. G. Strang, Linear Algebra and Its Applications, Thomson Brooks/Cole, Belmont, 2006.
3. L. Trefethen, Approximation Theory and Approximation Practice, SIAM, Philadelphia, 2013.
Additional bibliography:
1. Ch. Van Loan, Computational Frameworks for the Fast Fourier Transform, SIAM, Philadelphia, 1998.

Result of average student's workload

Activity	Time (working hours)
1. Total	100
2. Contact hours	45
3. Practical activities	40

Student's workload

Source of workload	hours	ECTS
Total workload	100	2
Contact hours	45	1
Practical activities	40	1