STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Numerical linear algebra		**1010342611010340006**
Field of study: **Mathematics**	Profile of study (general academic, practical): **(brak)**	Year /Semester: **1 / 1**
Elective path/specialty: **-**	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: **30** Classes: **-** Laboratory: **30** Project/seminars: **-**		No. of credits: **5**
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. 6652803
Wydział Elektryczny
ul. Piotrowo 3A 60-965 Poznań

Responsible for subject / lecturer:

dr Andrzej Maćkiewicz
email: andrzej.mackiewicz@put.poznan.pl
tel. 6652803
Wydział Elektryczny
ul. Piotrowo 3A 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic course of linear algebra. Algorithms of linear algebra. Numerical Methods.
2	**Skills**	Computer programming in high-level languages.
3	**Social competencies**	Ability to work in a group. Mandatory and punctuality in performing the tasks entrusted.

Assumptions and objectives of the course:

Numerical linear algebra is the intersection of numerical analysis and linear algebra and, more precisely, focuses on practical algorithms for solving on a computer problems of linear algebra. It is really a branch of functional analysis, but with the emphasis always on practical algorithmic ideas rather than mathematical technicalities.

This course is devoted for graduate students, and mature scientists in mathematics, computer science, engineering, and all disciplines in which numerical methods are used.

At the heart of most scientific computer codes lie matrix computations, so it is important to understand how to perform such computations efficiently and accurately. This course meets that need by providing a detailed introduction to the fundamental ideas of numerical linear algebra, dealing with small and medium sized, dense problems.

Since the 1970s, iterative methods have moved to center stage in scientific computing, and to them we devote the next course in the subject, mainly Iterative Methods in Linear Algebra devoted for the large and sparse problems (with applications) for which this course is a prerequisite.

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

Knowledge:

1. He/She knows the connections of the subject area with other branches of mathematics - [K_W07]
2. He/She knows advanced numerical techniques that support math work and understands their limitations. - [K_W08]

Skills:

1. Can use algebraic methods (with particular emphasis on linear algebra) in solving problems from different mathematical branches and practical tasks - [K_U10]
2. He/She uses the language and methods of functional analysis in mathematical analysis and its applications, in particular using the properties of classical Banach and Hilbert spaces. - [K_U09]

Social competencies:

1. He can work in teams; understands the need for systematic work on any project that has a long-term nature. - [K_K03]

Assessment methods of study outcomes

Homework 30%
Midterm 30%
Final Exam 40%

Course description

I What is Numerical Analysis and Numerical Linear Algebra?
II Fundamentals
III QR Factorization and Least Squares
IV Conditioning and Stability
V Systems of Equations
VI Eigenvalues and Eigenvectors
VII Systems of Nonlinear equations

Basic bibliography:

1. Kiełbasińsk A., Schwetlick H. Numeryczna algebra liniowa: wprowadzenie do obliczeń zautomatyzowanych, Warszawa : Wydaw. Nauk. -Techn., 1992.
2. G.H, i Van Loan Ch. Matrix Computation 4ed., J. Hopkins UP., 2013
3. A. Maćkiewicz , Algorytmy algebry liniowej. Metody bezpośrednie, Wydawnictwo Politechniki Poznańskiej, Poznań 2002.
4. Watkins D., Fundamentals of Matrix Computation 3rd ed., J. Wiley, 2010.

Additional bibliography:

1. L. Trefethen, David Bau, III, Numerical Linear Algebra, SIAM, Philadelphia, 1997.
2. Allaire G. Kaber S. , Numerical Linear Algebra, Springer 2002.
3. J.W. Demmel, Applied Numerical Linear Algebra, SIAM, Philadelphia, 1997.

Result of average student's workload

Activity	Time (working hours)

Student's workload

Source of workload	hours	ECTS
Total workload	62	5
Contact hours	32	1
Practical activities	30	1