

DESCRIPTION OF THE COURSE OF STUDY

Course code	0719-2ID-C19-M2	
Name of the course in	Polish	Matematyka 2
	English	Mathematics 2

1. LOCATION OF THE COURSE OF STUDY within the system of studies

1.1. Field of study	Data engineering
1.2. Mode of study	Full time studies
1.3. Level of study	First level studies
1.4. Profile of study*	General academic studies
1.5. Person/s preparing the course description	Hubert Przybycień
1.6. Contact	hprzybycien@ujk.edu.pl

2. GENERAL CHARACTERISTICS OF THE course of study

2.1. Language of instruction	english
2.2. Prerequisites*	Mathematics 1

3. DETAILED CHARACTERISTICS OF THE COURSE OF STUDY

3.1. Form of classes	Lectures, seminars	
3.2. Place of classes	classes in the teaching rooms of UJK	
3.3. Form of assessment	exam(lecture), passing with a note (seminar)	
3.4. Teaching methods	lecture – problem lecture, seminar - group discuss, solving tasks	
3.5. Bibliography	Required reading	1. G. Strang, <i>Introduction to linear algebra</i> , Wellesley-Cambridge-Press Sixth -edition. 2023.
	Further reading	1. G. Strang, <i>Linear algebra and its applications</i> , Academic Press 1976

4. OBJECTIVES, SYLLABUS CONTENT AND INTENDED LEARNING OUTCOMES

4.1. Course objectives (including form of classes)
Knowledge (lecture) C1. Introduction to basic algebraic structures and matrix calculus C2. Familiarization with important concepts and theorems related to vector spaces and linear operators C3. Introduction to matrix methods used in data analysis Skills (laboratory) C4. Developing skills in matrix operations C5. Cultivating the ability to solve systems of linear equations and perform matrix decompositions Social competences (laboratory) C6. Developing the habit of learning, improving one's own work skills, and formulating questions to deepen understanding of a given topic.
4.2. Detailed syllabus (including form of classes)
Lecture: Properties of binary operations, definitions of semigroups, groups, rings, fields. The field of complex numbers. Vector spaces: definition of vector space, examples, subspaces, sum and direct sum of subspaces. Vector systems, basis, and dimension of vector space. Linear mappings, kernel and image, the matrix of a linear mapping. Matrices: operations on matrices, the space of matrices. Row and column operations on matrices. The concept of rank and trace of a matrix. Systems of linear equations, Kronecker-Capelli theorem, Gaussian elimination method. Determinant of a matrix. Cramer's rule. Singular and non-singular matrices. Inverse matrix. Characteristic polynomial of a matrix, eigenvalues and eigenvectors of an endomorphism. Diagonal form of a matrix, canonical form of a matrix. Jordan matrix and basis. Scalar product. LU decomposition, QR decomposition, and other matrix factorizations. Singular value decomposition (SVD). Seminar: Study of the properties of binary operations, recognition of semigroups, groups, rings, and fields. Operations on complex numbers. Vector subspaces, sum and direct sum of subspaces. Basis of a vector space. Matrix of a lin-

ear transformation, calculating the kernel and image of a linear transformation. Operations on matrices. Studying the rank of a matrix. Solving systems of linear equations. Reducing to row echelon form and to reduced row/column echelon form through row operations. Computing determinants. Calculating the inverse matrix. Determining eigenvalues and eigenvectors, diagonalization of matrices. Defining and using scalar products and norms.

4.3 Intended learning outcomes

Code	A student, who passed the course	Relation to learning outcomes
within the scope of KNOWLEDGE:		
W01	Performs operations on complex numbers. Visualizes sets of complex numbers. Recognizes basic algebraic structures: groups, fields, vector spaces. Defines the basis and dimension of a vector space. Characterizes the concept of linear mapping and associated concepts, in particular, the matrix of the linear mapping. Defines basic characteristics of matrices: rank, determinant, trace, characteristic polynomial, and indicates their applications. Points out methods of matrix decomposition and their applications.	ID1A_W01
within the scope of ABILITIES:		
U01	Performs operations on matrices Calculates the determinant, rank, and trace of the matrix Solves systems of linear equations	ID1A_U01
U02	Determines the eigenvectors and eigenvalues of the matrix as well as decompositions and transformations of matrices.	ID1A_U01
within the scope of SOCIAL COMPETENCE:		
K01	Has awareness of the engineer's role in providing society with competent information in the field of object-oriented programming	ID1A_K01
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4.4. Methods of assessment of the intended learning outcomes

Teaching outcomes (code)	Method of assessment (+/-)																				
	Exam oral/written*			Test*			Project*			Effort in class*			Self-study*			Group work*			Others* e.g. standardized test used in e-learning		
	Form of classes			Form of classes			Form of classes			Form of classes			Form of classes			Form of classes			Form of classes		
	L	C	...	L	C	...	L	C	...	L	C	...	L	C	...	L	C	...	L	C	...
W01	+																				
U01					+																
U02					+																
K01					+																
...																					

*delete as appropriate

4.5. Criteria of assessment of the intended learning outcomes

Form of classes	Grade	Criterion of assessment
lecture (L) (including e-learning)	3	achieving <50-60)% of the requirements
	3,5	achieving <60-70)% of the requirements
	4	achieving <70-80)% of the requirements
	4,5	achieving <80-90)% of the requirements
	5	achieving <90-100)% of the requirements
classes (C)* (including e-learning)	3	achieving <50-60)% of the requirements
	3,5	achieving <60-70)% of the requirements
	4	achieving <70-80)% of the requirements
	4,5	achieving <80-90)% of the requirements

	5	achieving <90-100>% of the requirements
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5. BALANCE OF ECTS CREDITS – STUDENT’S WORK INPUT

Category	Student's workload	
	Full-time studies	Extramural studies
NUMBER OF HOURS WITH THE DIRECT PARTICIPATION OF THE TEACHER /CONTACT HOURS/	60	
Participation in lectures*	30	
Participation in classes, seminars, laboratories*	30	
INDEPENDENT WORK OF THE STUDENT/NON-CONTACT HOURS/	40	
Preparation for the lecture*	7	
Preparation for the classes, seminars, laboratories*	20	
Preparation for the exam/test*	13	
TOTAL NUMBER OF HOURS	100	
ECTS credits for the course of study	4	

*delete as appropriate

Accepted for execution (date and legible signatures of the teachers running the course in the given academic year)

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