University of Gdańsk

Subject card

Subject name and code	Mathematical Methods in Bioinformatics - Vector Analysis, PG_00193516						
Field of study	Bioinformatics						
Date of commencement of studies	October 2026		Academic year of realisation of subject	2026/2027			
Education level	Bachelor's studies		Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study			
Mode of study	full-time studies		Mode of delivery	at the university			
Year of study	1		Language of instruction	Polish			
Semester of study	2		ECTS credits	7.0			
Learning profile	academic		Assessment form	exam			
Conducting unit	Institute of Theoretical Physics and Astrophysics -> Faculty of Mathematics, Physics and Informatics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Waldemar Kłobus				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	45.0	0.0	0.0	0.0	90
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours	Self-study	SUM	
	Number of study hours	90		0.0	85.0	175	
Subject objectives	The aim of the course is to introduce the tools for studying and analyzing functions of several variables provided by linear algebra and differential calculus, as well as to present the applications of these tools in the analysis of specific physical and natural phenomena.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOINL3_U03] Graduate applies mathematical and statistical methods to describe phenomena and analyze data; has the ability to perform data analysis in professional databases used in bioinformatics	The student is able to: Use vector and matrix calculus Solve systems of linear equations using various methods Apply methods of multivariable calculus to study functions Solve simple partial differential equations Use multivariable calculus and linear algebra to describe and analyze physical and natural models.	[SU3] text preparation/written work [SU4] test/exam - oral or written
[BIOINL3_W03] Has sufficient knowledge of mathematical and statistical methods in order to describe and model biological phenomena and processes	The student knows: The concept of vector space and related concepts The principles of matrix calculus Methods for solving systems of linear equations Basic concepts and methods of multivariable calculus Methods for solving simple partial differential equations Applications of multivariable calculus and linear algebra in simple physical and natural models.	[SW4] test/exam - oral or written [SW3] text preparation/written work
[BIOINL3_W02] Has advanced scientific knowledge necessary to understand the basic processes in living organisms.	The student knows: The concept of vector space and related concepts The principles of matrix calculus Methods for solving systems of linear equations Basic concepts and methods of multivariable calculus Methods for solving simple partial differential equations Applications of multivariable calculus and linear algebra in simple physical and natural models.	[SW4] test/exam - oral or written [SW3] text preparation/written work

Subject contents

1. The concept of vector space, examples, linear combination of vectors, linearly independent systems, bases, dimension of a vector space, subspace.
2. Matrices, operations on matrices and their properties, rank of a matrix, determinant of a square matrix, Laplace expansion, elementary row and column operations, non-singular matrices, inverse matrix and its determination.
3. Eigenvalue problem of a linear operator; application to the description of simple linear population models
4. Systems of linear equations in multiple variables, matrix form, Cramer's theorem, Kronecker-Capelli theorem, Gaussian elimination method.
5. Partial derivatives of real-valued functions of several variables, gradient.
6. Determining local extrema of functions of several variables.
7. Vector product in 3-dimensional space and its properties.
8. Vector fields and their differentiation, potential fields, determining the potential, curl and divergence of a vector field, physical interpretations.
9. Simple partial differential equations.
10. Applications in the analysis of physical and natural systems: wave equation, heat transport equation, population models, fluid dynamics problems.

Prerequisites and co-requisites

Knowledge of differential calculus of functions of a single variable

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
	51.0%	60.0%
	51.0%	40.0%

Recommended reading

Basic literature	n
Supplementary literature	n
eResources addresses	

Example issues/ example questions/ tasks being completed

n

Work placement	Not applicable

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