



Subject card

Subject name and code	Statistics and Data Analysis, PG_00054689						
Field of study	Biotechnology						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2024/2025		
Education level	first-cycle 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	2	Language of instruction			Polish		
Semester of study	3	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Physical Chemistry -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jarosław Wawer					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	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	30	5.0		15.0	50	
Subject objectives	After a series of lectures and laboratories, the student will be able to: use the basic methods and tools of statistics, apply obtained knowledge to the analysis of the results of experiments.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K6_U11	Thanks to the tools of statistics and using IT tools (especially Python), the student is able to analyze data, including statistical analysis, at least in a very basic scope.			[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools		
	K6_W11	The student will be familiar with the basic tools in the field of computer science and bioinformatics (Python, Excel).			[SW1] Assessment of factual knowledge		
	K6_U01	Thanks to the subject, the student is able to analyze the provided data.			[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools		
	K6_W01	The acquired knowledge of mathematics and physics, combined with the knowledge of statistics, allows the student to analyze processes, including those related to biology.			[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects		

Subject contents	<p>Statistics</p> <ul style="list-style-type: none"> - statistical analysis of one variable - precision and accuracy - absolute error, relative error, determination of errors of measuring instruments, error propagation method - sample and general population - measures of the position of the central tendency, measures of dispersion - histogram and limit distribution - normal distribution, other types of distributions, parameters describing the distribution, skewness - standardization of the normal distribution, cumulative distribution function - central limit theorem - determination of the confidence interval <p>Verification of statistical hypotheses:</p> <ul style="list-style-type: none"> - types of errors, systematic errors, random errors - type I and II error - general information on how to perform statistical tests - statistical tests - examples, calculating the probability of a given phenomenon - Dixon Q test, F-Snedecor test, Student T test, other statistical tests. <p>Data analysis</p> <ul style="list-style-type: none"> - concepts: interpolation, approximation, extrapolation - correlation and regression - building a mathematical model, regression - data presentation on a graph - the quality of the model fit and the prognostic ability - assessment of the quality of the mathematical model, significance and adequacy of the model, assessment of linearity - the importance of the R2 coefficient, Anscombe quartet - function linearization - multiple regression <p>Validation of the measurement method. Elements of experimental optimization (in particular, a disadvantage of the Gauss method).</p>											
Prerequisites and co-requisites	Basic knowledge of mathematics.											
Assessment methods and criteria	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Subject passing criteria</th> <th style="width: 33%;">Passing threshold</th> <th style="width: 33%;">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>Laboratory - test</td> <td>50.0%</td> <td>40.0%</td> </tr> <tr> <td>Lecture - test</td> <td>50.0%</td> <td>60.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Laboratory - test	50.0%	40.0%	Lecture - test	50.0%	60.0%
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Recommended reading	Basic literature	1) J.R. Tylor Wstęp do analizy błędu pomiarowego PWN, Warszawa 2011 2) https://statquest.org/ (autor: Josh Starmer, University of North Carolina at Chapel Hill, Department of Genetics) 3) YouTube: Geek's Lesson, Statistics and Probability Full Course 4) J. B. Czermiński Metody statystyczne dla chemików PWN, Warszawa 1992 5) M. Sobczyk "Statystyka" PWN, Warszawa 2012										
	Supplementary literature	1) P. Konieczka Ocena i kontrola jakości wyników analitycznych PG, Gdańsk 2004 2) J. Mazerski Podstawy chemometrii PG 2004										
	eResources addresses	Adresy na platformie eNauczanie:										
Example issues/ example questions/ tasks being completed	<p>How many digits to show in the measured result? How to estimate the measurement error? What is precision and what is accuracy? How does Excel calculate standard deviation? How to compare two values with each other?</p> <p>The more parameters in the regression equation the better? What does R2 mean, the bigger R2 the better? What is the relationship between R2 and data linearity? How to assess the quality of the regression model?</p> <p>How to set the process parameters to obtain the highest possible reaction efficiency?</p>											
Work placement	Not applicable											