GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	STATISTICS AND DATA ANALYSIS, PG_00064381		
Field of study	Chemistry		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
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	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Physical Chemistry -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jarosław Wawer	
	Teachers		

Lesson types

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	40.0	75

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_U04] creates detailed documentation of the results obtained from the experiments carried out individually or as part of a team, analysing and interpreting the results in the form of text documents, spreadsheets, graphs, technological diagrams, multimedia presentations using correct chemical nomenclature	The student is able to develop detailed documentation of the results of experiments conducted independently or in a team, analyzing and interpreting data in textual or graphical form, and using correct nomenclature.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
[K6_K03] is aware of the importance of caring for the quality and diligence of the tasks performed, being responsible for their consequences	The student is aware of the importance of quality and accuracy in performed tasks and takes responsibility for their outcomes.	[SK5] Assessment of ability to solve problems that arise in practice [SK4] Assessment of communication skills, including language correctness
[K6_W01] applies his/her knowledge of selected branches of mathematics and physics to analyse, interpret and solve problems and to describe physical, chemical phenomena and technological processes	The student applies knowledge from selected areas of mathematics to analyze, interpret, and solve problems, as well as describe phenomena.	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>Course content – lecture
Statistics
- 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

Verification of statistical hypotheses:
- 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.

Data analysis
- 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

Validation of the measurement method.
Elements of experimental optimization (in particular, a disadvantage of the Gauss method).</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Basic knowledge of mathematics.</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Lecture - test</td><td>50.0%</td><td>60.0%</td></tr>
<tr><td>Laboratory - test</td><td>50.0%</td><td>40.0%</td></tr>
</table>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>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</td></tr>
<tr><td>Supplementary literature</td><td>1) P. Konieczka Ocena i kontrola jakości wyników analitycznych PG, Gdańsk 2004
2) J. Mazerski Podstawy chemometrii PG 2004</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table>
</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>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?

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?

How to set the process parameters to obtain the highest possible reaction efficiency?</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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