GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Inference in Multivariete Statistics, PG_00044136		
Field of study	Mathematics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Specialty subject group 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	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Divison of Differential Equations and Applications of Mathematics -> Institute of Applied Mathematics -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Anna Szafrańska	
	Teachers	dr inż. Anna Szafrańska	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	15.0	0.0	15.0	60

E-learning hours included: 0.0

eNauczanie source addresses:

Moodle ID: 4210 Wnioskowanie w wielowymiarowej statystyce
https://enauczanie.pg.edu.pl/2025/course/view.php?id=4210

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	60	5.0	60.0	125

Subject objectives

Classical statistical introduction to data science. Computer laboratory oriented on practicable R packages tools and/or Python language.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_K04] forms opinions on mathematical issues	Is able to draw conclusions from the results obtained using data analysis methods.	[SK5] Assessment of ability to solve problems that arise in practice
[K7_U06] uses probability distributions and their properties in practical issues, is familiar with the basics of statistics and the basics of statistical data processing	Uses techniques of mathematical statistics to analyze selected data sets with the help of a computer.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[K7_W07] describes well symbolic computation software package and statistical data processing package.	Is able to analyze empirical data using R packages.	[SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>Course content – lecture
Elements of linear algebra and functional analysis for multivariate statistical methods. Multivariate normal distribution, descriptive statistics and their distributions, principal component analysis, factor analysis, and cluster analysis.
Course content – laboratory
Implementation of topics:
1. Statistical distance.
2. Spectral distribution of the covariance matrix.
3. Multivariate normal distribution.
4. Distributions of descriptive statistics.
5. Decomposition of the covariance matrix.
6. Principal component analysis.
7. Cluster analysis - k-means method.
Course content – seminar
Preparing a presentation on a selected topic, e.g.: variable selection methods, multivariate linear regression, cluster analysis (hierarchical clustering, fuzzy clustering, density algorithms), discriminant analysis (linear and quadratic), decision trees, neural networks (unidirectional, recurrent, convolutional).</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Courses completed: Probability Theory, Mathematical Statistics.</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>Seminar</td><td>0.0%</td><td>10.0%</td></tr>
<tr><td>Laboratory</td><td>50.0%</td><td>45.0%</td></tr>
<tr><td>Exam</td><td>50.0%</td><td>45.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>J.Kogan, Introduction to Clustering Large and High-Dimensional Data, Cambridge University Press, 2007.

T.Panek, J.Zwierzchowski, Statystyczne metody wielowymiarowej analizy porównawczej, Oficyna Wydawnicza SGH, 2013.

I.Koch, Analysis of Multivariate and High Dimensional Data, Cambridge University Press, 2014.

R.Johnson, D.Wichern, Applied Multivariate Statistical Analysis, Pearson, 2014.</td></tr>
<tr><td>Supplementary literature</td><td>W.K.Hardle, L.Simar, Applied Multivariate Statistical Analysis, Springer, 2015.

C.Chatfield, A.J.Collins, Introduction to Multivariate Analysis, CRC, 2017.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Determine the principal components of the given covariance matrix. Using the k-means method, cluster the given data set.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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