



Subject card

Subject name and code	Statistics, Data Analysis and Machine Learning, PG_00071927						
Field of study	Circular economy and water management						
Date of commencement of studies	October 2026		Academic year of realisation of subject		2026/2027		
Education level	second-cycle studies		Subject group		Obligatory subject group in the field of study		
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		English		
Semester of study	1		ECTS credits		3.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Geotechnical and Hydraulic Engineering -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Wojciech Artichowicz				
	Teachers		dr inż. Wojciech Artichowicz dr Natalia Lipiejko				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	0.0	0.0	45
	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	45		5.0		25.0	75
Subject objectives	Gaining theoretical and practical knowledge in statistics, data analysis and basic machine learning.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_W03] demonstrates an advanced understanding of the applications of analytical, numerical, and conceptual methods and tools for solving problems related to both water management and the circular economy, including the analysis and regulation of resource flows (water, energy, materials) in environmental and technical systems.		Students understand and can use tools for data analysis, statistical calculations, and machine learning. They can prepare data and perform statistical analysis. They can select appropriate tools to solve data-driven problems. They also understand the basics of machine learning modeling and model development.		[SW1] Assessment of factual knowledge		
	[K7_U03] applies analytical, numerical, and experimental tools and methods at an advanced level to solve practical problems related to both water management and the circular economy, including the optimization of resource flows and technological processes.		Students understand and can use tools for data analysis, statistical calculations, and machine learning. They can prepare data and perform statistical analysis. They can select appropriate tools to solve data-driven problems. They also understand the basics of machine learning modeling and model development.		[SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task		
	[K7_W02] explains the significance and interrelationships between components of water systems and circular economy systems, using in-depth knowledge aligned with the main trends in environmental science, water engineering, and resource management.		The student is able to assess the existence of dependencies between systems based on data.		[SW1] Assessment of factual knowledge		

Subject contents	Course content – lecture		
	1. Probability and its interpretations 2. Random variables 3. Sample and general population 4. Data analysis and visualization 5. Statistical estimation 6. Statistical tests 7. Regression and correlation 8. Machine learning		
	Course content – laboratory		
	1. Spreadsheets and SQL databases as data analysis tools 2. Programming for data analysis and statistical computing 3. Data analysis workflow - data reporting 4. Statistical computing 5. Data visualization 6. Creating machine learning models		
Prerequisites and co-requisites	Computer skills, including spreadsheets and basic programming.		
	Knowledge of basic linear algebra and mathematical analysis (derivatives, integrals, and limits).		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	End test (lecture)	60.0%	30.0%
	Implementation of project tasks	60.0%	70.0%
Recommended reading	Basic literature	Jay L. Devore, „Probability and Statistics for Engineering and the Sciences. 8th edition.” Norman Lloyd Johnson, „Statistics and experimental design in engineering and the physical sciences.” James, G., Witten, D., Hastie, T., & Tibshirani, R. (2021). <i>An Introduction to Statistical Learning: With Applications in R</i> (2nd ed.). Springer.	
	Supplementary literature	Aurélien Géron "Hands-On Machine Learning with Scikit-Learn and PyTorch. Concepts, Tools, and Techniques to Build Intelligent Systems" O'Reilly Media	
	eResources addresses	Supplementary https://www.statlearning.com/ - A link to an official website with pdf version of the book: An introduction to statistical learning with applications in R and Python	
Example issues/ example questions/ tasks being completed	Data visualization		
	Comparison of two samples		
	Building a regression model		
Practical activities within the subject	Not applicable		

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