GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00066700		
Field of study	Technical Physics		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2026/2027
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	1	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Michał Piłat	
	Teachers	dr inż. Michał Piłat	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	0.0	30.0	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	2.0	18.0	50

Subject objectives

The aim of the course is to familiarize students with the elements of descriptive statistics with particular emphasis on techniques used in data science. The course will present the mathematical foundations of statistics and methods of implementing them in the Python programming language within built-in libraries such as Numpy, Scipy, Sympy, Pandas and Matplotlib. The effects of education are to be knowledgeable of selected statistical concepts, the ability to use statistical tools for analytical purposes and methods of implementing them in programming systems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W03] demonstrates awareness of current development trends and recent advances in physics-based technologies.	Student can programme in Python and use its libraries with modifications. Student can also create their own models based on recent developments in technology.	[SW3] Assessment of knowledge contained in written work and projects
[K7_U05] is able, individually or as part of a team (including in a leadership role), to plan and conduct advanced theoretical calculations, experimental studies and computer simulations aimed at solving complex and non-standard scientific and engineering problems, and to critically analyse results and formulate well-founded conclusions	Student can create a statistical analysis of a given set of data and arrive to conclusions.	[SU5] Assessment of ability to present the results of task
[K7_W04] possesses advanced knowledge of mathematical, numerical and simulation methods used in the description and modelling of physical phenomena.	Student knows terms and methods of descriptive statistics and probability theory. Student can exploit those terms and methods by using Python libraries.	[SW1] Assessment of factual knowledge
[K7_U06] is able to identify and assess risks, economic efficiency and the applicability of proposed engineering solutions, taking into account both technical and non-technical factors, including ethical considerations.	Student can analyse the data on the grounds of hypothesis tests and propose an explanation for the observed results.	[SU2] Assessment of ability to analyse information

Subject contents	Course content – laboratory Exploratory data analysis • Estimates of location • Estimates of variability • Exploring the data distribution • Exploring binary and categorical data • Correlation • Exploring two or more variables Data and sampling distribution • Differences between sample and population • Theory of probability: cumulative distribution fuction, probability density function • Types of discrete distibutions • Types of continuous distributions • Confidence intervals Statistical experiments and significance testing • Hypothesis tests • Parametic tests: test for mean • Nonparametric tests: test of skewness test and test of kurtosis • Statistical significance • Errors of I and II kind • Chi-square test • Bartlett's test • Shapiro-Wilk's test • Kołmogorow-Smirnow's test • Rank correlation: Kendall, Pearson, Spearman • Corellation analysis • Analysis of variance: ANOVA, Tukey's test Regression and prediction • Linear regression • Polynomial regression • Multiple linear regression • Regression diagnostics • Principal Components Analysis • Logistic regression
Prerequisites and co-requisites	Basics of programming in Python Basics of calculus and linear algebra.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Test	50.0%	50.0%
Project	50.0%	50.0%

Recommended reading

Basic literature	Peter Bruce, Andrew Bruce, Peter Gedeck, "Practical statistics for Data Scientists. 50+ Essential Concepts Using R and Python ", O'Reilly, Boston 2020 Robert Johansson "Numerical Python. Scientifing Computing and Data Science Applications with Numpy, SciPy i Matplotlib" Apress, 2019
Supplementary literature	Aurelien Geron "Hands-on Machine Learning with Scikit-Learn, Keras & TensorFlow", O'Reilly, Boston, 2019
eResources addresses	Basic https://enauczanie.pg.edu.pl/moodle/course/view.php?id=44865 - Course on eNauczanie

Example issues/ example questions/ tasks being completed	Describe 3 discrete and continuous probability distributions. Describe k-neighbours method Describe chi-square test. Analyse a given set of data.
Practical activites within the subject	Not applicable

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