



Subject card

Subject name and code	Methods of Analyzing Scientific Research Results, PG_00069759						
Field of study	Informatics, Electronics and Telecommunications, Biomedical Engineering, Biomedical Engineering, Biomedical Engineering, Space and Satellite Technologies, Automatic Control, Cybernetics and Robotics						
Date of commencement of studies	February 2025	Academic year of realisation of subject			2025/2026		
Education level	second-cycle studies	Subject group					
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			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Multimedia Systems -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Bartłomiej Mróz					
	Teachers	dr inż. Bartłomiej Mróz					
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						
	eNauczenie source address: https://enauczenie.pg.edu.pl/2025/course/view.php?id=2468 Moodle ID: 2468 Metody Analizy Wyników Badań Naukowych https://enauczenie.pg.edu.pl/2025/course/view.php?id=2468						
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	0.0	0.0	30		
Subject objectives	<p>The course prepares students to independently design, conduct, and report scientific research using modern statistical methods. The course covers the fundamentals of data analysis (distributions, measures of central tendency, assumption testing) through the general linear model (GLM) including regression, t-tests, ANOVA, ANCOVA, and repeated measures analysis to linear mixed models (LMM).</p> <p>Particular emphasis is placed on robust methods: bootstrapping, trimmed means, and M-estimators, which allow for reliable analysis when parametric test assumptions are violated. Students learn data validation, control of confounding variables, and reporting of results in accordance with APA standards.</p> <p>All laboratory classes are conducted in R using real data sets, providing practical skills necessary for scientific research, including in the areas of UX, HCI, and other empirical fields.</p>						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W03] knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	Knows and understands the theoretical foundations of the general linear model (GLM) and its extensions, including regression, ANOVA, ANCOVA, and linear mixed models (LMM), along with the complex relationships between these methods	[SW1] Assessment of factual knowledge
	[K7_W101] is able to make an in-depth identification of key objects and phenomena related to the field of study, as well as theories that describe them and applicable analytical and design methods	Identifies the assumptions of parametric tests (normality, homogeneity of variance, sphericity), understands the consequences of their violations, and knows modern robust methods (bootstrapping, trimmed means, M-estimators)	[SW1] Assessment of factual knowledge
	[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by: - appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation, - application of appropriate methods and tools	Able to select the appropriate statistical analysis method for the type of data and structure of the experiment, perform the analysis in R, and critically interpret the results, taking into account the assumptions and limitations of the methods used	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
	[K7_U03] can design, according to required specifications, and make a complex device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	Can design and implement a complete scientific data analysis process: from testing assumptions, through the selection and implementation of appropriate statistical tests, to reporting results in accordance with APA standards	[SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task
Subject contents	<p>Course content – lecture</p> <ol style="list-style-type: none"> 1. From hypothesis to measurement: the foundations of scientific research 2. Practical basics of modeling and statistical analysis 3. Data analysis using graphs 4. Preparing laboratory test reports in APA format 5. Testing assumptions 6. Correlation 7. Linear regression 8. Logistic regression 9. Comparison of two means 10. Comparison of multiple means: ANOVA (GLM 1) 11. Analysis of covariance, ANCOVA (GLM 2) 12. Factorial analysis of variance: Factorial ANOVA (GLM 3) 13. ANOVA with repeated measures (GLM 4) 14. Mixed-design ANOVA (GLM 5) <p>Course content – laboratory</p> <ol style="list-style-type: none"> 1. Linear regression 2. Logistic regression 3. t-test 4. Comparison of multiple means (ANOVA) 5. Factorial ANOVA 6. ANOVA with repeated measures 7. Linear mixed models - LMM 		
Prerequisites and co-requisites	<p>It is required to have completed a basic course in statistics and a course in mathematics covering differential and integral calculus, as well as basic computer skills in data analysis.</p> <p>In addition, basic knowledge of R (or another language for data analysis), experience in carrying out a research project, and the ability to read scientific literature in English are recommended.</p>		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	evaluation of laboratory task reports	50.0%	50.0%
	test on the lecture part	50.0%	50.0%

Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Field, A. P. (2022). An adventure in statistics. London: SAGE Publications. https://profandyfield.com/discoverse/ais/ 2. Field, A. P. (2026). Discovering statistics using R and RStudio. London: SAGE Publications. https://profandyfield.com/discoverse/dsur/
	Supplementary literature	<ol style="list-style-type: none"> 1. James, G., Witten, D., Hastie, T., & Tibshirani, R. (2021). An introduction to statistical learning: With applications in R (2nd ed.). Springer. doi: 10.1007/978-1-0716-1418-1 https://www.statlearning.com/ 2. West, B. T., Welch, K. B., & Galecki, A. T. (2022). Linear mixed models: A practical guide using statistical software (3rd ed.). Chapman and Hall/CRC. doi: 10.1201/9781003181064 https://websites.umich.edu/~bwest/almussp.html 3. Howell, D. C. (2020). Statistical methods for psychology (8th ed.). Wadsworth Publishing.
	eResources addresses	
Example issues/ example questions/ tasks being completed	Students perform tasks involving linear regression with diagnostics, including residual diagnostics and outlier identification, comparison of several groups using ANOVA with post hoc tests, analysis of factorial experiments with interpretation of main effects and interactions, and application of bootstrapping to determine confidence intervals when normality is violated. Typical topics include the assumptions of parametric tests and methods for their verification, interpretation of interactions in factorial designs, differences between ANOVA with repeated measures and mixed ANOVA, and decisions about using robust methods instead of data transformation. Each lab ends with the preparation of a research report in APA format containing tables of results and graphs.	
Practical activities within the subject	Not applicable	

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