

COURSE OFFERED

Name of the course	Polish	Analiza statystyczna danych
	English	Statistical Data Analysis

1 LOCATION OF THE COURSE WITHIN THE EDUCATION SYSTEM

1.1. Section ¹	Section of Exact and Natural Sciences
1.2. Discipline ²	Biological Sciences; Chemical Sciences; Physical Sciences; Earth and Environmental Sciences
1.3. Type of education	Full-time
1.4. Level of education	Doctoral School (PQF Level 8)
1.5. Person preparing the course description	prof. dr hab. Francesco Giacosa
1.6. Contact	fgiacosa@ujk.edu.pl

2 GENERAL CHARACTERISTICS OF THE COURSE

2.1. Type of course ³	General subject
2.2. Language of the course	English

3 DETAILED CHARACTERISTICS OF THE COURSE

3.1. Type of classes ⁴	Lecture (L); practical classes (C)
3.2. Number of hours ⁵	20 hours: 10 hours of lectures and 10 hours of practical classes
3.3. Location of classes	Classroom at Jan Kochanowski University in Kielce
3.4. Type of assessment	Lecture: pass/fail. Practical classes: graded pass.
3.5. Didactic methods	Lectures with worked examples; analytical and numerical problem-solving; data analysis, discussion and individual project work
3.6. Literature	basic 1. J. R. Taylor, An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, 2nd edition, University Science Books, 1997. 2. A. M. Mathai and H. J. Haubold, Probability and Statistics: A Course for Physicists and Engineers, De Gruyter, 2018. 3. S. Siegel, Nonparametric Statistics for the Behavioral Sciences, McGraw-Hill, 1956.
	supplementary 1. Particle Data Group, "Probability" and "Statistics", Review of Particle Physics, 2026; pdg.lbl.gov/2026/reviews/contents_sports.html. 2. H.-W. Bandemer, Mathematics of Uncertainty: Ideas, Methods, Application Problems, Springer, 2006.

¹ Sections: Humanities; Social Sciences; Exact and Natural Sciences; Medical and Health Sciences; Arts.

² Discipline as specified in the curriculum of the Doctoral School.

³ General subjects; general subjects in the discipline; specialised subjects in the discipline.

⁴ Classes, lecture or seminar.

⁵ Consistent with the curriculum of the Doctoral School of Jan Kochanowski University in Kielce.

4 OBJECTIVES, SYLLABUS CONTENT AND INTENDED LEARNING OUTCOMES

4.1. Course objectives

C01 (L) Explain the statistical and mathematical foundations of data analysis: distributions, uncertainty analysis, estimation and hypothesis testing.

C02 (L, C) Develop methods for fitting data, estimating parameter uncertainties and assessing fit quality.

C03 (C) Solve analytical and numerical problems independently and interpret and report research data responsibly.

4.2. Syllabus content

Lectures (L): 10 hours

1. Statistical methods in research; variable types and measurement scales; populations, samples and sampling; descriptive measures and graphical presentation. (1 h)

2. Probability distributions and their properties: Gaussian, binomial and Poisson distributions. (1 h)

3. Statistical and systematic errors; measurement uncertainties and their propagation; significant digits and reporting results. (2 h)

4. Point and interval estimation; confidence intervals and uncertainties of estimated parameters. (1 h)

5. Hypothesis testing; Type I and II errors and test power; one- and two-population tests, Student's t-tests, parametric and nonparametric methods. (2 h)

6. Graphical and formal tests of normality; goodness-of-fit tests and tests of independence. (1 h)

7. Correlation and regression; fitting, parameter estimation, residuals and assessment of fit quality. (1 h)

8. Analysis of variance (ANOVA) and post-hoc tests; interpretation of statistical conclusions. (1 h)

Practical classes (C): 10 hours

1. Data preparation: filtering, sorting and export; descriptive statistics and plots by variable type and measurement scale. (1 h)

2. Gaussian, binomial and Poisson distributions; graphical and formal assessment of normality. (1 h)

3. Uncertainty propagation, statistical and systematic errors, and significant digits: analytical and numerical exercises. (2 h)

4. Point estimates, confidence intervals and parameter uncertainties for sample data. (1 h)

5. Student's t-tests and nonparametric tests for one or two populations; assumptions, errors and power. (2 h)

6. Goodness-of-fit and independence tests for experimental or observational data. (1 h)

7. Correlation and regression; fitting parameters, evaluating residuals and fit quality. (1 h)

8. ANOVA, post-hoc comparisons and interpretation; preparation of a short data-analysis report. (1 h)

Examples and datasets are drawn from the disciplines of the Section of Exact and Natural Sciences.

4.3 SUBJECT LEARNING OUTCOMES

Learning outcome	A doctoral student who has passed the course	Reference to Doctoral School learning outcomes
In the area of KNOWLEDGE		
W01	Knows and understands statistical research methodology, including probability distributions, uncertainty analysis, estimation, hypothesis testing and assessment of fit quality.	SD_W03
In the area of SKILLS		
U01	Develops and applies a statistical analysis plan; selects and adapts analytical or numerical methods for a research problem, estimates parameters and uncertainties, and draws justified conclusions.	SD_U02
In the area of SOCIAL COMPETENCE		
K01	Conducts data analysis independently and responsibly; reports methods and uncertainties transparently and respects the public ownership of research results and intellectual property.	SD_K05

4.4 METHODS OF ASSESSMENT OF THE INTENDED LEARNING OUTCOMES

SUBJECT LEARNING OUTCOMES	METHOD OF ASSESSMENT (+ / -)																				
	Oral / written exam			Test			Project			Activity in class			Own work			Group work			Other		
	Type of classes			Type of classes			Type of classes			Type of classes			Type of classes			Type of classes			Type of classes		
	L	C	S	L	C	S	L	C	S	L	C	S	L	C	S	L	C	S	L	C	S
W01	-	-	-	+	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-
U01	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-
K01	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-

L = lecture; C = practical classes; S = seminar. + = method used; - = method not used.

Lecture: a written test with conceptual questions and short calculations. Practical classes: an individual data-analysis project and assessed classwork. The project documents the choice of methods, uncertainty analysis, statistical tests or fitting, interpretation of results and acknowledgement of data and sources. Project work and class discussion assess independence, transparent reporting and respect for intellectual property.

4.5 CRITERIA OF ASSESSMENT OF THE INTENDED LEARNING OUTCOMES

Form of classes	Grade / result	Criterion of assessment
Lecture (L)	Pass	At least 51% of the maximum points in the written test. No numerical grade is awarded.
Practical classes (C)	3.0	61–68% of the total points for the project and assessed classwork.
	3.5	69–76% of the total points for the project and assessed classwork.
	4.0	77–84% of the total points for the project and assessed classwork.
	4.5	85–92% of the total points for the project and assessed classwork.
	5.0	93–100% of the total points for the project and assessed classwork.

Fail: below 51% in the lecture test; grade 2.0 for practical classes below 61% of the total points.

Accepted for implementation

.....
(date and signature of the lecturer)