DESCRIPTION OF THE COURSE OF STUDY

Course code	0719-2ID-C31-S2	
Name of the course in	Polish	***Statystyka II***
	English	***Statistics II***

1. LOCATION OF THE COURSE OF STUDY within the system of studies

1.1. Field of study	Data Engineering
1.2. Mode of study	Full-time studies
1.3. Level of study	First-cycle (Bachelor of Engineering)
1.4. Profile of study*	General academic
1.5. Person/s preparing the course description	Dr Anatolii Nikitin
1.6. Contact	anatolii.nikitin@ujk.edu.pl

2. GENERAL CHARACTERISTICS OF THE course of study

2.1. Language of instruction	Polish
2.2. Prerequisites*	Fundamentals of Mathematics, Mathematics I, Probability Calculus I, Statistics I

3. DETAILED CHARACTERISTICS OF THE COURSE OF STUDY

3.1. **Form of classes**		Lecture, Laboratory
3.2. **Place of classes**		On-site classes in the teaching facilities of Jan Kochanowski University (UJK)
3.3. **Form of assessment**		Exam (lecture), graded credit (laboratory)
3.4. **Teaching methods**		Lecture – informative lecture; Laboratory – problem-based learning method
3.5. **Bibliography**	**Required reading**	Koronacki J. Mielniczuk J. Statystyka dla studentów kierunków technicznych i przyrodniczych. Wydawnictwa Naukowo-Techniczne. Warszawa 2001. Johnson, R. A., & Wichern, D. W. (2018). *Applied Multivariate Statistical Analysis* (6th ed.). Pearson.
	Further reading	James, G., Witten, D., Hastie, T., & Tibshirani, R. (2021). *An Introduction to Statistical Learning with Applications in R* (2nd ed.). Springer. Bąk, A. (2009). Statystyczna analiza danych z wykorzystaniem programu R.: Wydawnictwo Naukowe PWN**.**

4. OBJECTIVES, SYLLABUS CONTENT AND INTENDED LEARNING OUTCOMES

4.1. **Course objectives** ***(including form of classes)***

Lecture:

C1: To familiarize students with the basic methods of descriptive and inferential analysis of multivariate quantitative and qualitative data.

C2: To introduce fundamental statistical models for multivariate data analysis.

Laboratory:

C1: To develop practical skills in conducting multivariate data analysis using a selected statistical software package.

C2: To foster a critical attitude toward the reliability of data and the validity of analytical results.

4.2. Detailed syllabus ***(including form of classes)***

Lectures

1. Forms of representation of multivariate data and their graphical presentation. Descriptive analysis of multivariate data. (2 hrs)
2. Measures of location and variability. (2 hrs)
3. Measures of dependence. Correlation coefficients (Pearson, Spearman, Kendall) and the basics of correlation-regression analysis as tools for describing relationships between variables. (4 hrs)
4. Multivariate regression models. (2 hrs)
5. Principal Component Analysis (PCA) and its geometric interpretation. (6 hrs)
6. Multivariate normal distribution. Selected statistical tests. (2 hrs)
7. Multifactor analysis of variance (ANOVA). Modifications of variance analysis for ordinal variables. (2 hrs)
8. Distance measures. Selected topics in cluster analysis and object classification. (6 hrs)

9. Model-based cluster analysis. (2 hrs)
10. Bayesian classifiers. (2 hrs)

(including e-learning)

Each lecture may be conducted either on-site or online (corresponding presentations and other teaching materials are available).

Laboratory:

1. Descriptive analysis of multivariate data. (2 hrs)
2. Measures of location and variability. (2 hrs)
3. Measures of dependence. Correlation coefficients (Pearson, Spearman, Kendall) and the basics of correlation-regression analysis as tools for describing relationships between variables. (4 hrs)
4. Multivariate regression models. (2 hrs)
5. Principal Component Analysis (PCA) and its geometric interpretation. (6 hrs)
6. Multivariate normal distribution. Selected statistical tests. (2 hrs)
7. Multifactor analysis of variance (ANOVA). Modifications of variance analysis for ordinal variables. (2 hrs)
8. Distance measures. Selected topics in cluster analysis and object classification. (6 hrs)
9. Model-based cluster analysis. (2 hrs)
10. Bayesian classifiers. (2 hrs)

(including e-learning)

Each laboratory session may be conducted either on-site or online (corresponding presentations and other teaching materials are available).

4.3 Intended learning outcomes

Code	A student, who passed the course	Relation to learning outcomes
within the scope of **KNOWLEDGE:**		
W01	Describes techniques of multivariate statistical analysis.	ID1A_W02
W02	Characterizes models of comparative multivariate analysis.	ID1A_W02
within the scope of **ABILITIES:**		
U01	Applies the learned techniques and models in data analysis.	ID1A_U01 ID1A_U05 ID1A_U06
U02	Interprets results obtained using the learned techniques and models.	ID1A_U01 ID1A_U06
U03	Uses basic functions of a selected statistical software package for multivariate analysis.	ID1A_U01 ID1A_U13 ID1A_U06
within the scope of **SOCIAL COMPETENCE:**		
K01	Is able to independently set priorities in data analysis and plan stages of research work.	ID1A_K01
K02	Systematically reviews scientific literature and source materials on multivariate analysis methods, and critically evaluates the usefulness and reliability of presented data and results.	ID1A_K01

4.4. Methods of assessment of the intended learning outcomes

Teaching outcomes *(code)*	**Method of assessment (+/-)**								
	Written exam			***Colloquium (quiz/test)***			***Other – Individual laboratory options***		
	Form of classes			***Form of classes***			***Form of classes***		
	W	L	...	W	L	...	W	L	...
W01	+								
W02	+			+					
U01					+			+	
U02					+			+	
U03					+			+	
K01				+				+	

K02	+								

4.5. **Criteria of assessment of the intended learning outcomes**		
Form of classes	**Grade**	**Criterion of assessment**
lecture (L) (including e-learning)	**3**	Achievement of <**50–60**% of the requirements applied in the assessment methods
	3,5	Achievement of **<60–70%** of the requirements applied in the assessment methods
	4	Achievement of **<70–80%** of the requirements applied in the assessment methods
	4,5	Achievement of **<80–90%** of the requirements applied in the assessment methods
	5	Achievement of <**90–100**% of the requirements applied in the assessment methods
classes (C)* (including e-learning)	**3**	Achievement of <**50–60**% of the requirements applied in the assessment methods
	3,5	Achievement of **<60–70%** of the requirements applied in the assessment methods
	4	Achievement of **<70–80%** of the requirements applied in the assessment methods
	4,5	Achievement of **<80–90%** of the requirements applied in the assessment methods
	5	Achievement of <**90–100**% of the requirements applied in the assessment methods
others)	**3**	Achievement of <**50–60**% of the requirements applied in the assessment methods
	3,5	Achievement of **<60–70%** of the requirements applied in the assessment methods
	4	Achievement of **<70–80%** of the requirements applied in the assessment methods
	4,5	Achievement of **<80–90%** of the requirements applied in the assessment methods
	5	Achievement of <**90–100**% of the requirements applied in the assessment methods

5. BALANCE OF ECTS CREDITS – STUDENT'S WORK INPUT

Category	**Student's workload**	
	Full-time studies	**Extramural studies**
NUMBER OF HOURS WITH THE DIRECT PARTICIPATION OF THE TEACHER /CONTACT HOURS/	***60***	
*Participation in lectures**	30	
*Participation in classes, seminars, laboratories**	30	
*Preparation in the exam/ final test**	***40***	
*Others (please specify e.g. e-learning)**	10	
INDEPENDENT WORK OF THE STUDENT/NON-CONTACT HOURS/	15	
*Preparation for the lecture**	15	
*Preparation for the classes, seminars, laboratories**	***100***	
*Preparation for the exam/test**	**4**	
*Gathering materials for the project/Internet query**	***60***	
Preparation of multimedia presentation	30	
*Others **	30	
TOTAL NUMBER OF HOURS	***40***	
ECTS credits for the course of study	10	

delete as appropriate

Accepted for execution *(date and legible signatures of the teachers running the course in the given academic year)*

29.09.2025 Anatolii Nikitin