Appendix No. 1.5 to the Resolution No. 61/2025
of the Rector of the University of Rzeszów

SYLLABUS

REGARDING THE QUALIFICATION CYCLE FROM 2026 TO 2029
ACADEMIC YEAR 2027/2028

1. BASIC COURSE/MODULE INFORMATION

Course/Module title	Basic of Mathematical Statistics
Course/Module code *	
Faculty (name of the unit offering the field of study)	Faculty of Exact and Technical Sciences
Name of the unit running the course	Institute of Mathematics
Field of study	Mathematics
Qualification level	First-cycle studies (Bachelor's)
Profile	General academic
Study mode	Full-time
Year and semester of studies	Year 2, Semester 4
Course type	Major subject
Language of instruction	English
Coordinator	Rostyslav Hryniv, PhD, DSc
Course instructor	Rostyslav Hryniv, PhD, DSc

* - as agreed at the faculty

1.1. Learning format – number of hours and ECTS credits

Semester (no.)	Lectures	Classes	Laboratories	Seminars	Practical classes	Internships	others	**ECTS credits**
4	15		30					4

1.2. Course delivery methods

☒ conducted in a traditional way
☒ involving distance education methods and techniques

1.3. Course/Module assessment (exam, pass with a grade, pass without a grade)
Laboratory – pass with a grade
Lecture – pass without a grade

2.PREREQUSITES

Knowledge of basic concepts and facts from probability theory.

3. OBJECTIVES, LEARNING OUTCOMES, COURSE CONTENT, AND APPLIED TEACHING METHODS

3.1 Course/Module objectives

O1	Familiarizing students with basic concepts, facts and methods in the field of descriptive statistics, parameter estimation and statistical hypothesis testing.
O2	Developing students' ability to use methods of mathematical statistics to solve problems and interpret the obtained results.

3.2 COURSE/MODULE LEARNING OUTCOMES (TO BE COMPLETED BY THE COORDINATOR)

Learning Outcome	The description of the learning outcome defined for the course/module	Relation to the degree programme outcomes
LO_01	The student knows basic concepts and facts from descriptive statistics, correlation analysis, parameter estimation and statistical hypothesis verification.	K_W01, K_W02, K_W03, K_W04
LO_02	The student is able to apply statistical methods to describe social, natural and technical phenomena. is able to apply the acquired knowledge to model analysis.	K_U01, K_U02
LO_03	The student is able to conduct simple statistical inference using concepts of mathematical statistics and utilizing it tools.	K_U13
LO_04	The student understands the importance of learned facts and methods of mathematical statistics in interpreting social, natural and economic phenomena. is able to critically evaluate information from various sources.	K_K01, K_K02, K_K03

3.3. Course content (to be completed by the coordinator)

A. Lectures

Content outline
1. Basic issues of statistical data analysis. Classification of variables. Measurement scales. 2. Empirical distribution of a trait and its description. Basic parameters of quantitative and qualitative traits. Measures of central tendency, positional measures and measures of dispersion. 3. Examining the dependence of two traits. Linear correlation coefficient (Pearson's). Rank correlation coefficients (Spearman's). Chi-square test of independence. Chuprov's, Cramer's and Pearson's coefficients for qualitative traits. 4. Foundations of estimation theory. Properties of estimators. Interval estimation. The problem of minimal sample size. 5. Testing statistical hypotheses. Parametric significance tests. Chi-square goodness-of-fit test.

B. Classes, laboratories, seminars, practical classes

Content outline
1. **Descriptive Statistics:** Calculating fundamental parameters of empirical distributions using raw data and frequency tables. Graphical representation of data distributions. 2. **Analysis of Quantitative Variables:** Constructing and interpreting correlation tables and marginal distributions. Calculating covariance and Pearson's linear correlation coefficient for bivariate data. 3. **Rank Correlation:** Calculating and interpreting non-parametric measures of association: Spearman's rho and Kendall's tau. 4. **Analysis of Qualitative Variables:** Testing independence between categorical variables using the Chi-square test. Calculating association coefficients (Chuprov's, Cramer's V, and Pearson's C) and interpreting the results. 5. **Estimation of the Mean:** Constructing confidence intervals for the population mean under various conditions: known variance, unknown variance, and unknown population distribution (large-sample approximations). 6. **Estimation of Variance and Proportions:** Constructing confidence intervals for the population variance and the population proportion (structure index). 7. **Sample Size Determination:** Calculating the minimum sample size required to achieve specific margins of error and confidence levels. 8. **Hypothesis Testing:** Formulating and executing statistical tests, including parametric significance tests and Chi-square goodness-of-fit tests.

3.4 . Methods of Instruction

Lecture: a problem-solving lecture/a lecture supported by a multimedia presentation/ distance learning

Laboratory classes: designing and conducting experiments

4. ASSESSMENT TECHNIQUES AND CRITERIA

4.1 Methods of evaluating learning outcomes

Learning outcome	Methods of assessment of learning outcomes (e.g. test, oral exam, written exam, project, report, observation during classes)	Learning format (lectures, classes,...)
LO_01	observation during classes, laboratory tasks, project	lecture, laboratory
LO_02	observation during classes, laboratory tasks, project	lecture, laboratory
LO_03	observation during classes, laboratory tasks, project	lecture, laboratory
LO_04	observation during classes, laboratory tasks, project	lecture, laboratory

4.2 Course assessment criteria

Passing the laboratory on the basis of laboratory tasks and activity during classes. The condition for passing the exercises is obtaining at least 50% of points from each laboratory task. The final grade is then determined according to the scale:

below 50% pts. – fail,

[50 – 60%] pts. – satisfactory,

[60 – 70%] pts. – satisfactory plus,

[70 – 80%] pts. – good,

[80 – 90%] pts. – good plus,

[90– 100%] pts. – very good.

Activity during exercises can raise the grade by at most half a degree.

Passing the lecture on the basis of a positive grade from a statistical data analysis project.

5. Total student workload needed to achieve the intended learning outcomes – number of hours and ECTS credits

Activity	Number of hours
Course hours	45
Other contact hours involving the teacher (consultation hours, examinations)	2
Non-contact hours - student's own work (preparation for classes or examinations, projects, etc.)	55
Total number of hours	102
Total number of ECTS credits	4

* One ECTS point corresponds to 25-30 hours of total student workload

6. Internships related to the course/module

Number of hours	*Not applicable*
Internship regulations and procedures	*Not applicable*

7. Instructional materials

Compulsory literature:

1. Casella, G., Berger, R. L. (2002). Statistical inference. CRC Press.
2. James, G., Witten, D., Hastie, T., Tibshirani, R. (2013). An introduction to statistical learning: with applications in R. Springer New York. https://doi.org/10.1007/978-1-4614-7138-7

Complementary literature:

1. Agresti, A., Franklin, C., Klingenberg, B. (2022). Statistics: the art and science of learning from data.5th ed. Pearson.
2. Dalgaard, P. (2008). Introductory statistics with R. 2nd ed. Springer New York. https://doi.org/10.1007/978-0-387-79054-1

Approved by the Head of the Department or an authorised person