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 2028/2029

1. BASIC COURSE/MODULE INFORMATION

Course/Module title	Machine Learning
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 3, Semester 6
Course type	Specialisation course
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**
6			30					2

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

2. PREREQUISITES

Knowledge of basic definitions and theorems in the field of probability calculus and mathematical statistics; basics of programming in the R language.

3. OBJECTIVES, LEARNING OUTCOMES, COURSE CONTENT, AND INSTRUCTIONAL METHODS

3.1. Course/Module objectives

O1	Familiarising students with the basic concepts, ideas, and methods of machine learning, including supervised and unsupervised learning.
O2	Developing students' skills in using machine learning methods to describe and solve various problems.
O3	Developing students' skills in using R software packages to analyse data and machine learning algorithms.

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 and understands algorithmic techniques in the field of machine learning, including symbolic and numeric representations.	K_W07
LO_02	The student is aware of the usefulness of various machine learning methods and of the R environment for solving practical, conceptual, and technical problems.	K_W08
LO_03	The student can construct algorithms using machine learning techniques, including symbolic and numeric representations.	K_U14, K_U16, K_U22
LO_04	The student can use the learned methods and formalised models to model tasks and machine learning algorithms, including supervised and unsupervised learning, in IT systems and software.	K_U14, K_U16, K_U22
LO_05	The student understands the importance of machine learning in business operations. They are aware of the role of learning algorithms in IT systems and software. They are ready to assess the validity of using appropriate methods and models in specific situations	.K_K04, K_K05, K_K07

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

Lab assignment topics:

Content outline
1. Introduction to machine learning. Supervised and unsupervised learning.
2. Cluster analysis.
3. Linear regression methods.
4. Logistic regression.
5. Naive Bayes classifier.
6. Decision trees.
7. Support vector machines.
8. Principal component analysis.

3.4. Methods of Instruction

Laboratory classes: computer work, practical project.

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	lab
LO_02	observation during classes, laboratory tasks	lab
LO_03	observation during classes, laboratory tasks	lab
LO_04	observation during classes, laboratory tasks	lab
LO_05	observation during classes, laboratory tasks	lab

4.2 Course assessment criteria

Passing the laboratory classes:

Individual assessment of completed laboratory tasks during an individual interview. The grade is based on 50% of the correctness of the completed work and 50% of the correctness of the answers to the questions. The condition for passing the laboratory classes is obtaining at least 50% of the points for each task. The final grade is then determined according to the following 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 classes may raise the final grade by a maximum of half a grade.

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

Activity	Number of hours
Course hours	30
Other contact hours involving the teacher (consultation hours, examinations)	5
Non-contact hours - student's own work (preparation for classes or examinations, projects, etc.)	25
Total number of hours	60
Total number of ECTS credits	2

* 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. James, G., Witten, D., Hastie, T., Tibshirani, R. (2013). An introduction to statistical learning: with applications in R. Springer New York. 2. Boehmke, B., Greenwell, B. (2019). Hands-on machine learning with R. Chapman and Hall/CRC. 3. Deisenroth, M. P., Faisal, A. A., Ong, C. S. (2020). Mathematics for machine learning. Cambridge University Press.
Complementary literature: 1. Wickham, H., Çetinkaya-Rundel, M., Grolemund, G. (2023). R for data science (2nd ed.). O'Reilly Media. 2. Shalev-Shwartz, S., Ben-David, S. (2014). Understanding machine learning: from theory to algorithms. Cambridge University Press. 3. Hastie, T., Tibshirani, R., Friedman, J. (2009). The elements of statistical learning: data mining, inference, and prediction. Springer New York. 4. Bishop, C. M. (2006). Pattern recognition and machine learning. Springer.

Approved by the Head of the Department or an authorised person