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 | Introduction to Probability Theory |
| 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 3 |
| 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** |
|---|---|---|---|---|---|---|---|---|
| 3 | 30 | 30 | | | | | | 6 |

**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)
Lecture - exam,
Classes - pass with a grade,

**2. PREREQUISITES**

| |
|---|
| Preparation in the field of school mathematics, calculus 1 |

## 3. Objectives, Learning Outcomes, Course Content, and Instructional Methods

### 3.1. Course/Module objectives

| | |
|---|---|
| O1 | Familiarization students with basic methods of probability theory. |
| O2 | Practicing noticing random phenomena and processes in the surrounding reality and describing them in terms of probability theory. |
| O3 | Developing calculational and interpretive skills. |

### 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 various definitions of probability. | K_W01, K_W03 |
| LO_02 | The student knows and understands discrete and continuous probability distributions. | K_W01, K_W03 |
| LO_03 | The student knows and understands the laws of large numbers and the central limit theorem. | K_W02, K_W04 |
| LO_04 | The student is able to apply combinatorial schemes in tasks. | K_U01, K_U02, K_U12 |
| LO_05 | The student is able to solve tasks from classical probability. | K_U01, K_U02, K_U12 |
| LO_06 | The student is able to determine the moments of discrete and continuous one-dimensional and two-dimensional distributions. | K_U01, K_U02, K_U12 |
| LO_07 | The student is ready to recognize the limitations of their own knowledge, understands the need for further education and the need to apply the acquired knowledge in practice, using the opinions of experts, determines the priorities serving the solution of a task. | K_K01, K_K02, K_K03 |

### 3.3 Course content (completed by the coordinator)

A. Lecture

| Content outline |
| --- |
| Foundations of probability theory: elementary and random events, probability; axiomatics (probability space); probability in classical and geometric terms. |
| Elements of combinatorics (permutations, variations, combinations). |
| Conditional probability, total probability and Bayes' theorem. |
| Discrete probability distributions (probability mass function, cumulative distribution function, binomial, geometric, hypergeometric, Poisson distributions). |
| Continuous probability distributions (density function, cumulative distribution function, uniform, normal and exponential distribution). |
| Moments of discrete and continuous random variables. |
| Distribution of a pair of random variables (joint, marginal and conditional distribution, independence of random variables). |
| Law of large numbers. |
| Central limit theorem. |

B. Classes, laboratories, seminars, practical classes

| Content outline |
| --- |
| Foundations of probability theory: elementary and random events, probability; axiomatics (probability space); probability in classical and geometric terms. |
| Elements of combinatorics (permutations, variations, combinations). |
| Conditional probability, total probability and Bayes' theorem. |
| Discrete probability distributions (probability mass function, cumulative distribution function, binomial, geometric, hypergeometric, Poisson distributions). |
| Continuous probability distributions (density, cumulative distribution function, uniform, normal and exponential distribution). |
| Moments of discrete and continuous random variables. |
| Distribution of a pair of random variables (joint, marginal and conditional distribution, independence of random variables). |
| Law of large numbers. |
| Central limit theorem. |

### 3.4 Teaching methods

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

**Classes:** text analysis and discussion/project work (research project, implementation project, practical project)/ group work (problem solving, case study, discussion)/didactic games/ distance learning

## 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 | exam | lecture |
| LO_02 | exam | lecture |
| LO_03 | exam | lecture |
| LO_04 | exam, test, observation during classes | lecture, classes |
| LO_05 | exam, test, observation during classes | lecture, classes |
| LO_06 | exam, test, observation during classes | lecture, classes |
| LO_07 | observation during classes | lecture, classes |

### 4.2 Course assessment criteria

**Passing exercises** based on quizzes and activity during classes.
The condition for passing the exercises is obtaining at least 50% of points from each quiz. 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.

**Exam:** The condition for passing the exam is obtaining at least 50% of points from it. 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.

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

| Activity | Number of hours |
|---|---|
| Course hours | 60 |
| Other contact hours involving the teacher (consultation hours, examinations) | 5 |
| Non-contact hours - student's own work (preparation for classes or examinations, projects, etc.) | 85 |
| Total number of hours | 150 |
| Total number of ECTS credits | 6 |

* 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. Ross, S. M. (2024). A first course in probability. 10th ed. Pearson.
2. Stirzaker, D. (2012). Elementary Probability. 2nd ed. Cambidge Univ. Press.

Complementary literature:

1. Feller, W. (1968). An introduction to probability theory and its applications (Vol. 1). Wiley.
2. Grinstead, C. M., Snell, J. L. (2012). Introduction to probability. 2nd ed. American Mathematical Society.
3. Grimmett, G., Welsh, D. (2014). Probability: an introduction. 4th ed. Oxford University Press.

Approved by the Head of the Department or an authorised person