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 2026/2027.

1. BASIC COURSE/MODULE INFORMATION

Course/Module title	Discrete Mathematics
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 1, Semester 2
Course type	Major subject
Language of instruction	English
Coordinator	Edyta Trybucka, PhD
Course instructor	

* - according to the arrangements in the Unit

1.1.Learning format – number of hours and ECTS credits

Semester (no.)	Lectures	Classes	Laboratories	Seminars	Practical classes	Internships	others	**ECTS credits**
2	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)
Classes – pass with a grade, lecture – exam

2. PREREQUISITES

Calculus 1, Linear algebra and geometry 1, Introduction to logic and set theory.

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

3.1. Course/Module objectives

O1	Familiarization students with the properties of finite sums and products, as well as different methods of summing finite sums.
O2	Familiarizing students with the basic concepts of recurrence relations and methods for solving them, as well as methods of proof using mathematical induction.
O3	Familiarizing students with elements of number theory, modular arithmetic, performing calculations modulo n. Applications in prime factorization and encryption.

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 the basic concepts and methods used to describe problems in discrete mathematics, and has knowledge of proof methods used in discrete mathematics. The student has knowledge of computational techniques used in discrete mathematics, understands the importance of proof in mathematics, and the importance of assumptions in mathematical reasoning. The student can illustrate known concepts with examples and, using counterexamples, can refute false hypotheses and invalid reasoning. The student understands the methods of	K_W01, K_W02 K_W03, K_W04, K_W08

	discrete mathematics: mathematical induction, the theory of recurrence equations, techniques and properties of counting sets and functions, the concepts and theorems of modular arithmetic, and applies basic primality tests and ciphers. He or she knows and understands the dilemmas of modern civilization that discrete mathematics can help describe and explain.	
LO_02	The student correctly formulates definitions and theorems in an understandable manner, is able to analyze problems and find solutions based on acquired knowledge, formulates opinions on basic discrete mathematics topics, and understands the importance of discrete mathematics in mathematics. They can use discrete mathematics terminology to define concepts, formulate theorems, and develop simple mathematical models. They recognize the presence of discrete mathematics issues in various mathematical and computer science problems. Understands the relationship between number theory and cryptography.	K_U01, K_U02, K_U10
LO_03	The student is willing to acknowledge the limitations of their own knowledge and skills and therefore understands the need for continuous learning through independent literature and online research on topics discussed in class. The student expresses opinions on theoretical and practical issues in mathematics. The student understands the need to apply acquired knowledge in practice, drawing on expert opinions, and identifies priorities	K_K01, K_K02, K_K03

	for solving problems. The student is ready to present a critical attitude towards received content, especially when it lacks logical justification.	

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

A. Lectures

Content outline
Finite sums and products. Properties of finite sums and products. Various methods of summing finite sums, including summation by perturbation.
Induction and recursion. Strong and weak principles of mathematical induction, recursion, Towers of Hanoi, recursive equations, iterating recursive equations, recursion trees, the universal recursion theorem. Generating function.
Elements of number theory. The greatest common divisor, Euclid's algorithm, extended Euclid's algorithm, prime factorization, Dirichlet's theorem, Bertrand-Chebyshev's theorem, Erdös's theorem. The Sieve of Eratosthenes algorithm.
Modular arithmetic. Congruences, multiplicative inverse, modular exponentiation, Fermat's little theorem, Euler's function and theorem. Linear congruences, systems of parallel congruences, the Chinese remainder theorem.
Cryptography. Introduction to cryptography. The Caesar cipher and its mathematical foundations, linear encryption. Alberti's polyalphabetic cipher. Private-key and public-key ciphers, the RSA algorithm – construction and theoretical foundations.

B. Classes, laboratories, seminars, practical classes

Content outline
Finite sums and products. Properties of finite sums and products. Various methods of summing finite sums, including summation by perturbation.
Induction and recursion. Strong and weak principles of mathematical induction, recursion, Towers of Hanoi, recursive equations, iterating recursive equations, recursion trees, the universal recursion theorem. Generating function.

Elements of number theory. The greatest common divisor, Euclid's algorithm, extended Euclid's algorithm, prime factorization, Dirichlet's theorem, Bertrand-Chebyshev's theorem, Erdös's theorem. The Sieve of Eratosthenes algorithm.
Modular arithmetic. Congruences, multiplicative inverse, modular exponentiation, Fermat's little theorem, Euler's function and theorem. Linear congruences, systems of parallel congruences, the Chinese remainder theorem.
Cryptography. Introduction to cryptography. The Caesar cipher and its mathematical foundations, linear encryption. Alberti's polyalphabetic cipher. Private-key and public-key ciphers, the RSA algorithm – construction and theoretical foundations.

3.4. Methods of Instruction

Lecture: lecture supported by a multimedia presentation (possibility of using MS Teams).
Classes: problem solving, discussion.

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, exam, test	lectures, classes
LO-02	observation during classes, exam, test	lectures, classes
LO-03	observation during classes, exam, test	lectures, classes

4.2 Course assessment criteria

Classes: passing based on tests and activity during classes. A minimum of 50% of points from each test is required to pass. Final grade according to the scale: below 50% – fail, [50–60%) – satisfactory, [60–70%) – satisfactory plus, [70–80%) – good, [80–90%) – good plus, [90–100%] – very good. Class activity may increase the final grade by up to half a grade.

Exam: a minimum of 50% is required to pass. Final grade according to the scale: below 50% – fail, [50–60%) – satisfactory, [60–70%) – satisfactory plus, [70–80%) – good, [80–90%) – good plus, [90–100%] – 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.Richard Johnsonbaugh, Discrete Mathematics, Pearson, 2017. 2. Edward Scheinerman, Mathematics: A Discrete Introduction, Cengage Learning, 2012. 3. Bernard Kolman, Robert Busby, Sharon C. Ross, Discrete Mathematical Structures, Pearson, 2017.

Complementary literature:
1. Kenneth H. Rosen, Discrete Mathematics and Its Applications, McGraw-Hill Education, 2018.
2.Susanna S. Epp, Discrete Mathematics with Applications, Cengage Learning, 2019.

Approved by the Head of the Department or an authorised person