SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş Bolyai University**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Department of Mathematics**
1.4 Field of study	**Mathematics**
1.5 Study cycle	**Bachelor**
1.6 Study programme / Qualification	**Mathematics Computer Science**

2. Information regarding the discipline

2.1 Name of the discipline	MLE0070 Matematical Logic and Set Theory						
2.2 Course coordinator	prof. dr. Andrei Marcus						
2.3 Seminar coordinator	prof. dr. Andrei Marcus						
2.4. Year of study	**1**	2.5 Semester	**1**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Compulsory**

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar/laboratory	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					30
Additional documentation (in libraries, on electronic platforms, field documentation)					15
Preparation for seminars/labs, homework, papers, portfolios and essays					30
Tutorship					9
Evaluations					10
Other activities:					-

3.7 Total individual study hours	94
3.8 Total hours per semester	150
3.9 Number of ECTS credits	6

4. Prerequisites (if necessary)

4.1. curriculum	- Profound knowledge of high school math, especially of the following topics: - elements of propozitional and predicate calculus - operations with sets - functions; - injectivity, surjectivity, bijectivity - number sets - divizibility in Z; primes; - modular arthmetic - counting arguments

4.2. competencies	- ability to perform symbolic calculations ability to operate with abstract concepts - ability to do logical deductions - ability to solve math problems based on aquired notions

5. Conditions (if necessary)

5.1. for the course	• blackboard, projector
5.2. for the seminar /lab activities	• blackboard

6. Specific competencies acquired

Professional competencies	• ability to perform symbolic calculations in various structures (oredered sets, lattices etc) • ability to operate with abstract concepts • ability to complex logical deductions • ability to solve mathematics problems bases on aquired notions	
Transversal competencies	- abstract reasoning - applying mathematics in real life - ability to solve problems	

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• Basic knowledge on First Order Logic, Set Theory, and Arithmetic. Ability to solve difficult problems
7.2 Specific objective of the discipline	• students will operate with fundamental concepts of logic, set theory and number theory • students will aquire knowlegde first order predicates, relations, equivalence, cardinals and ordinals, number systems, divisibility, congruences, combinatorics. • students solve problems, theoretical and practical, using instruments of modern mathematics.

8. Content

8.1 Course	Teaching methods	Remarks
Week 1. Propositional Logic. Formulas, truth values, tautologies.	Explanation, dialogue, examples, proofs	
Week 2. Normal forms in propositional logic. First order Logic. Predicates, quantifiers.	Explanation, dialogue, examples, proofs	
Week 3. Methods of mathematical proof. Sets and operations with sets.	Explanation, dialogue, examples, proofs	
Week 4. Binary relations. Functions. Injective, surjective, bijective functions.	Explanation, dialogue, examples, proofs	
Week 5. Equivalence relations and partitions, factor sets, kernel of a function.	Explanation, dialogue, examples, proofs	
Week 6. Factorization of functions	Explanation, dialogue,	

	examples, proofs	
Week 7. Ordered sets, lattices.	Explanation, dialogue, examples, proofs	
Week 8. Boole algebras and Boole rings.	Explanation, dialogue, examples, proofs	
Week 9. Axiomatic number theory. The Frege-Russell constructions and the Peano axioms	Explanation, dialogue, examples, proofs	
Week 10. Construction of integers and rationals.	Explanation, dialogue, examples, proofs	
Week 11. Cardinal numbers. Operations with cardinal numbers.	Explanation, dialogue, examples, proofs	
Week 12. Ordering cardinal numbers. Finite, countable, infinite sets.	Explanation, dialogue, examples, proofs	
Week 13. Elements of Combinatorics. Counting arguments.	Explanation, dialogue, examples, proofs	
Week 14. Ordinal Numbers.	Explanation, dialogue, examples, proofs	
Bibliography [1] Marcus, A.: *Logică și teoria mulțimilor*, web notes 2015. [2] Breaz, S.; Covaci, R.: *Elemente de logica, teoria multimilor si aritmetica*, Editura Fundatiei pentru Studii Europene, Cluj-Napoca, 2006.		
8.2 Seminar / laboratory	Teaching methods	Remarks
Week 1. Propositional Logic. Formulas, truth values, tautologies.	Explanation, dialogue, examples, proofs	
Week 2. Normal forms in propositional logic. First order Logic. Predicates, quantifiers.	Explanation, dialogue, examples, proofs	
Week 3. Methods of mathematical proof. Sets and operations with sets.	Explanation, dialogue, examples, proofs	
Week 4. Binary relations. Functions. Injective, surjective, bijective functions.	Explanation, dialogue, examples, proofs	
Week 5. Equivalence relations and partitions, factor sets, kernel of a function.	Explanation, dialogue, examples, proofs	
Week 6. Factorization of functions	Explanation, dialogue, examples, proofs	
Week 7. Ordered sets, lattices.	Explanation, dialogue, examples, proofs	
Week 8. Boole algebras and Boole rings.	Explanation, dialogue, examples, proofs	
Week 9. Axiomatic number theory. The Frege-Russell constructions and the Peano axioms	Explanation, dialogue, examples, proofs	
Week 10. Construction of integers and rationals.	Explanation, dialogue, examples, proofs	
Week 11. Cardinal numbers. Operations with cardinal numbers.	Explanation, dialogue, examples, proofs	
Week 12. Ordering cardinal numbers. Finite, countable, infinite sets.	Explanation, dialogue, examples, proofs	
Week 13. Elements of Combinatorics. Counting arguments.	Explanation, dialogue, examples, proofs	
Week 14. Ordinal Numbers.	Explanation, dialogue, examples, proofs	
Bibliography		

1. Epp, S.: Discrete Mathematics with Applications. 4th ed. Brooks/Cole, Boston, 2011.
2. Krantz, S. G.: Discrete Mathematics Demystified. McGraw-Hill, New York, 2009.
3. Levy, A.: Basic Set Theory. Dover Publications, New York, 1979.
4. Lidl, R., Pilz, G.: Applied Abstract Algebra. Springer-Verlag, Berlin, 1998.
5. Ross, K. A., Wright Ch., Discrete Mathematics. Pearson Education, New Jersey, 2003.

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- Such a course (often called Discrete Mathematics) exists in the curricula of all major universities in Romania and abroad;
- Mathematical Logic and Number Theory are fundamental topics and have multiple applications in other branches of mathematics, as well as in Computer Science and in Philosophy.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	- know the basic principles of the field; - apply the new concepts	- Two written tests	80%
10.5 Seminar/lab activities	- problem solving	- homeworks	20%
10.6 Minimum performance standards			
➢ to aquire minimum 5 (out of 10) points to pass the exam			

Date	Signature of course coordinator	Signature of seminar coordinator
14.04.2021	Prof.dr. Andrei Mărcuș	Prof.dr. Andrei Mărcuș

Date of approval ..... Signature of the head of department

Prof. dr. Octavian Agratini