

SYLLABUS

Topics in Algebra III (for teachers in Mathematics)

Academic year 2026-2027

1. Information regarding the programme

1.1. Higher Education Institution	Babeş-Bolyai University
1.2. Faculty	Mathematics and Computer Science
1.3. Department	Mathematics
1.4. Field	Mathematics
1.5. Level of study	Master
1.6. Degree programme / Qualification	Modern Methods in Mathematics Teaching
1.7. Form of education	Full-time

2. Information regarding the discipline

2.1. Course title	Topics in Algebra III (for teachers in Mathematics)			Course code	MME3048
2.2. Course coordinator	Prof. Dr. Simion-Sorin Breaz				
2.3. Seminar coordinator	Prof. dr. Simion-Sorin Breaz				
2.4. Year of study	II	2.5. Semester	4	2.6. Type of assessment	Exam
2.7. Course status	Optional			2.8. Course type	Specialisation subject

3. Total estimated time (hours per semester of teaching activities)

3.1 Hours per week	3	Of which: 3.2 course	2	3.3 seminar/laboratory	1
3.4 Total hours in the curriculum	36	Of which: 3.5 course	24	3.6 seminar/laboratory	12
Time allocation for individual study (IS) and self-taught activities (ST)					hours
Learning from textbooks, course materials, bibliography, and notes (IS)					42
Additional research in the library, on subject-specific electronic platforms, and on-site					50
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					50
Tutoring (professional guidance)					25
Examinations					22
Other activities					-
3.7 Total individual study hours	189				
3.8 Total hours per semester	225				
3.9 Number of ECTS credits	9				

4. Prerequisites (if necessary)

4.1. curriculum	
4.2. competencies	

5. Conditions (if necessary)

5.1. for the course	
5.2. for the seminar /lab activities	

6.1. Competencies resulting from the completion of the degree programme (as referred to in the curriculum)¹

Professional competencies	
Competency code	Competency
CP3	perform analytical mathematical calculations
CP1	develop problem-solving strategies
CP6	disseminate results among the scientific community
Transversal competencies	
Competency code	Competency
CT3	work independently
CT6	think analytically

6.2. Learning outcomes relevant to the degree programme (as referred to in the curriculum)²

Learning outcomes targeted by the subject		
Competency code	Knowledge and comprehension	Specific academic skills
CP3	5. The graduate formulates observations and differentiates notions, properties and assertions from advanced disciplines of mathematics through examples and counterexamples.	5. The graduate verifies, on particular cases or by constructing examples or counterexamples, the validity of mathematical statements. The graduate translates a practical situation into mathematical language, solves the problem obtained and interprets the results obtained.
CP1	1. The graduate analyses the hypotheses and conclusions from mathematical assertions and links them within the demonstration.	1. The graduate demonstrates the acquisition and use of effective research methods and techniques.
CP7, CT3	3. The graduate compares and distinguishes related notions and their properties from advanced mathematics disciplines in the curriculum.	3. The graduate is able to identify and formulate significant problems which form the basis for further research.
CT6	4. The graduate critically studies the specialized literature, including by using international databases, identifying fundamental concepts.	4. The graduate applies appropriate techniques for solving advanced problems.

7. Subject-specific learning outcomes

Knowledge and comprehension
1. The student has acquired the specific knowledge which are necessary for solving problems.
2. The student knows fundamental notions of algebra as well as methods of applying them in fields of science related to mathematics and computer science.
Specific academic skills
1. The student is able to construct clear and well-supported mathematical arguments to explain mathematical problems, topics, and ideas in writing.
2. The student is able to prove theorems using mathematical language in theoretical courses and will be able to present these results both orally and in writing.

¹ The professional and/or transversal skills targeted by the subject for which the course description is prepared will be copied from the curriculum of the degree programme. For each competency, the complete entry, including the competency code, will be copied with the exact wording that appears in the curriculum, without any changes. If no competency is copied from either of the two categories, the row corresponding to that category is deleted from the table.

² The learning outcomes relevant for the degree programme and targeted by the subject for which the course description is prepared will be listed. The entries, copied without any changes from the Curriculum by subject type (Core Subject/Specialisation Subject/Complementary Subject), are listed under the corresponding competency.

8. Contents



















8.1 Course	Teaching methods	Remarks
1. Preliminaries	Lectures, didactical demonstration, conversation.	
2. Division with remainder.	Lectures, didactical demonstration, conversation.	
3. Elementary divisibility	Lectures, didactical demonstration, conversation.	
4. Greatest common divisor	Lectures, didactical demonstration, conversation.	
5. The Euclidian Algorithm	Lectures, didactical demonstration, conversation.	
6. Prime numbers. The Sieve of Eratostene.	Lectures, didactical demonstration, conversation.	
7. The fundamental theorem of arithmetic.		
8. Congruences	Lectures, didactical demonstration, conversation.	
9. Linear Diophantine Equations. The Chinese Remainder Theorem	Lectures, didactical demonstration, conversation.	
10. Residues systems and Euler's totient	Lectures, didactical demonstration, conversation.	
11. Theorems of Fermat, Euler, Wilson	Lectures, didactical demonstration, conversation.	
12. Multiplicative number theoretic functions	Lectures, didactical demonstration, conversation.	
13. Mobius Function	Lectures, didactical demonstration, conversation.	
14. Perfect, Mersenne and Fermat numbers	Lectures, didactical demonstration, conversation.	
Bibliography		
[1] Becheanu, M. si colectiv, Algebra pentru perfectionarea profesorilor, Ed. Didactica si Pedagogica, Bucuresti, 1983.		
[2] S. Breaz, C. Pelea: Exercises in Number Theory, LAP LAMBERT Academic Publishing, 2018		
[3] S. Breaz, C. Pelea: Elemente de teoria numerelor si combinatorica, Casa Cartii de stiinta, 2017.		
[4] Burton D. Elementary number theory, 6ed., MGH, 2007		
[5] Vraciu, C., Vraciu, M., Elemente de aritmetică, Ed. All, 1998		
8.2 Seminar / laboratory	Teaching methods	Remarks
1. Induction	problematization, exercises, problem solving,	
2. Division with remainder.	problematization, exercises, problem solving,	

3. Elementary divisibility	problematization, exercises, problem solving,	
4. Greatest common divisor	problematization, exercises, problem solving,	
5. The Euclidian Algorithm	problematization, exercises, problem solving,	
6. Prime numbers.	problematization, exercises, problem solving,	
7. The fundamental theorem of arithmetic. Applications	problematization, exercises, problem solving,	
8. Perfect squares	problematization, exercises, problem solving,	
9. Methods to solve diphantine equations (1)	problematization, exercises, problem solving,	
10. Methods to solve diphantine equations (2)	problematization, exercises, problem solving,	
11. Multiplicative number theoretic functions		
12. Problems for math contests (1)	problematization, exercises, problem solving,	
13. Problems for math contests (2)	problematization, exercises, problem solving,	
14. Problems for math contests (3)		
Bibliography		
[1] T. Andreescu, D. Andrica: Number Theory. Structure, examples and problems, Birkhauser, 2009.		
[2] S. Breaz, C. Pelea: Exercises in Number Theory, LAP LAMBERT Academic Publishing, 2018.		
[3] S. Breaz, C. Pelea: Elemente de teoria numerelor si combinatorica, Casa Cartii de stiinta, 2017.		
[4] Panaitopol, L., Serbanescu, D.: Probleme de teoria numerelor si combinatorica pentru juniori, Ed. Gill		
[5] ***, Probleme date la diverse concursuri.		

9. Evaluation

Type of activity	9.1 Evaluation criteria	9.2 Evaluation methods	9.3 Share in the grade (%)
9.4 Course	Concepts and basic results	Final exam	50%
	Standard examples		
9.5 Seminar/lab activities	Ability to use the concepts in order to solve problems	Final exam and a midterm test.	25%+25%
9.6 Minimum performance standards			
At least grade 5 from 10.			

10. SDG labels (Sustainable Development Goals)³

	Sustainable Development Generic Label							
								
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	X
								No label applies
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Date:

11.04.2026

Signature of course coordinator

Prof. Dr. Breaz Simion-Sorin

Signature of seminar coordinator

Prof. Dr. Breaz Simion-Sorin .

Date of approval:

25.04.2026

Signature of the head of department

Prof. dr. Andrei Mărcuș

³ Select a single label which, according to the [Implementation of SDG labels in the academic process](#), best matches the subject. If the subject addresses sustainable development in a generic manner (i.e. by presenting/introducing the general framework of sustainable development, etc.), then the Sustainable Development generic label may be applied. If none of the labels describe the subject, select the last option: "No label applies."