

COURSE DESCRIPTION

Algebra 2 (Basic algebraic structures)

Academic year 2026-2027

1. Programme-related data

1.1. Higher education institution	Babeş-Bolyai University
1.2. Faculty	Mathematics and Computer Science
1.3. Department	Mathematics
1.4. Field of study	Mathematics
1.5. Study cycle	Bachelor
1.6. Study programme/Qualification	Mathematics Computer Science
1.7. Form of education	Full-time education

2. Course-related data

2.1. Course title	Algebra 2 (Basic Algebraic Structures)			Course code	MLE0021
2.2. Course coordinator	Prof. PhD. Septimiu Crivei				
2.3. Seminar coordinator	Prof. PhD. Septimiu Crivei				
2.4. Year of study	1	2.5. Semester	2	2.6. Type of assessment	Exam
2.7. Course status	Compulsory		2.8. Course type	Core subject	

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

3.1. Number of hours per week	4	of which: 3.2. course	2	3.3. seminar/ laboratory/ project	2
3.4. Total of hours in the curriculum	56	of which: 3.5. course	28	3.6. seminar/ laboratory	28
Time allocation for individual study (IS) and self-taught activities (ST)					hours
Learning from textbooks, course materials, bibliography, and notes (IS)					28
Additional research in the library, on subject-specific electronic platforms, and on-site					20
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					28
Tutoring (professional guidance)					14
Examinations					4
Other activities					0
3.7. Total hours of individual study (IS) and self-taught activities (ST)				94	
3.8. Total hours per semester				150	
3.9. Number of credits				6	

4. Prerequisites (where applicable)

4.1. curriculum-related	
4.2. skills-related	

5. Specific conditions (where applicable)

5.1. course-related	
5.2. seminar/laboratory-related	

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

Professional competencies	
Competency code	Competency
CP2	perform analytical mathematical calculations
CP6	think abstractly
CP8	study relationships between quantities
Transversal competencies	
Competency code	Competency
CT4	Solve problems
CT5	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
CP2	7. The student/graduates selects, explains, and specifies the mathematical foundations applied in computer science, including formal logic, algebra, probability, and statistics.	7. The student/graduates applies, evaluates, and proposes mathematical methods for modeling, simulating, and solving computer science problems.
CP6	4. The student/graduate defines the basic concepts from advanced mathematics disciplines in the curriculum.	4. The student/graduate answers questions and correctly and rigorously formulates the statements of mathematical assertions (lemmas, propositions, theorems) from the disciplines in the curriculum.
CP8	3. The student/graduate formulates observations and differentiates notions, properties, and assertions from the core disciplines of mathematics through examples and counterexamples.	3. The student/graduate identifies and describes the essential elements in the construction of proofs of mathematical assertions (lemmas, propositions, theorems), recognizes errors in reasoning, and corrects them.
CT4, CT5	2. The student/graduate compares and distinguishes related notions and their properties from the core disciplines of mathematics.	2. The student/graduate recognizes and analyzes the necessary and/or sufficient conditions in the statements of mathematical assertions and specifies their role in the proof.

7. Subject-specific learning outcomes

Knowledge and comprehension
1. The student is able to ensure the formation of skills specific to the Mathematics-related disciplines needed to complete the assignments.
2. The student knows fundamental notions related to Algebra, and methods of applying them to areas of science related to Mathematics and Computer Science.

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.

Specific academic skills
1. The student will construct clear and well-supported mathematical arguments to explain mathematical problems, topics, and ideas in writing.
2. The student will prove theorems using the language of mathematics in theoretical junior/senior level courses and present those results both orally and in writing.

8. Contents

8.1. Course	Teaching and learning methods	Remarks³
1. Groups	Interactive exposure Explanation Conversation Didactical demonstration	
2. Subgroups. Generated subgroup. Subgroup lattice	Interactive exposure Explanation Conversation Didactical demonstration	
3. Group homomorphisms	Interactive exposure Explanation Conversation Didactical demonstration	
4. Cyclic groups. Order of an element	Interactive exposure Explanation Conversation Didactical demonstration	
5. Equivalence relations induced by a subgroup	Interactive exposure Explanation Conversation Didactical demonstration	
6. Normal subgroups. Factor group	Interactive exposure Explanation Conversation Didactical demonstration	
7. Isomorphism theorems for groups	Interactive exposure Explanation Conversation Didactical demonstration	
8. Permutation groups. Special groups	Interactive exposure Explanation Conversation Didactical demonstration	
9. Rings and fields	Interactive exposure Explanation Conversation Didactical demonstration	
10. Subrings and subfields	Interactive exposure Explanation Conversation Didactical demonstration	
11. Ring homomorphisms	Interactive exposure Explanation	

³ For example, organisational aspects, recommendations for students, specific aspects relating to the course/seminar, such as inviting experts in the field, etc.

	Conversation Didactical demonstration	
12. Ideals. Factor ring	Interactive exposure Explanation Conversation Didactical demonstration	
13. Special rings	Interactive exposure Explanation Conversation Didactical demonstration	
14. Rings of polynomials	Interactive exposure Explanation Conversation Didactical demonstration	

Bibliography

1. I.D. ION, N. RADU, Algebra (ed.4), Editura Didactica si Pedagogica, 1990.
2. S. CRIVEI, Basic Abstract Algebra, Ed. Casa Cartii de Stiinta, Cluj-Napoca, 2002, 2003.
3. W.J. GILBERT, W.K. NICHOLSON, Modern Algebra with Applications, John Wiley, 2004.
4. I. PURDEA, I. POP, Algebra, Editura GIL, Zalau, 2003.
5. J. ROTMAN, Advanced Modern Algebra, Prentice Hall, New Jersey, 2002.

8.2. Seminar/ laboratory	Teaching and learning methods	Remarks
1. Groups	Interactive exposure Explanation Conversation Didactical demonstration	
2. Subgroups. Generated subgroup. Subgroup lattice	Interactive exposure Explanation Conversation Didactical demonstration	
3. Group homomorphisms	Interactive exposure Explanation Conversation Didactical demonstration	
4. Cyclic groups. Order of an element	Interactive exposure Explanation Conversation Didactical demonstration	
5. Equivalence relations induced by a subgroup	Interactive exposure Explanation Conversation Didactical demonstration	
6. Normal subgroups. Factor group	Interactive exposure Explanation Conversation Didactical demonstration	
7. Isomorphism theorems for groups	Interactive exposure Explanation Conversation Didactical demonstration	
8. Permutation groups. Special groups	Interactive exposure Explanation Conversation Didactical demonstration	

9. Rings and fields	Interactive exposure Explanation Conversation Didactical demonstration	
10. Subrings and subfields	Interactive exposure Explanation Conversation Didactical demonstration	
11. Ring homomorphisms	Interactive exposure Explanation Conversation Didactical demonstration	
12. Ideals. Factor ring	Interactive exposure Explanation Conversation Didactical demonstration	
13. Special rings	Interactive exposure Explanation Conversation Didactical demonstration	
14. Rings of polynomials	Interactive exposure Explanation Conversation Didactical demonstration	

Bibliography

1. G. CALUGAREANU, P. HAMBURG, Exercises in basic ring theory, Kluwer, Dordrecht, 1998.
2. I.D. ION, C. NITA, D. POPESCU, N. RADU, Probleme de algebra, Editura Didactica si Pedagogica, Bucuresti, 1981.
3. I. PURDEA, C. PELEA, Probleme de algebra, EIKON, Cluj-Napoca, 2008.

9. Evaluation




















Type of activity	9.1 Evaluation criteria ⁴	9.2 Evaluation methods ⁵	9.3 Percentage in the final grade
9.4. Course	Knowledge of concepts, results, examples	Midterm exam, final exam	1/3 of the grade
9.5. Seminar/ laboratory	Problem solving	Midterm exam, final exam	2/3 of the grade
9.6 Minimum standard for passing			
The final grade must be at least 5.			

10. SDG labels (Sustainable Development Goals)⁶

⁴ The evaluation criteria must directly reflect the learning outcomes targeted at the level of the degree programme respectively at the level of the subject. More specifically, the learning outcomes set out in the expected learning outcomes are assessed.

⁵ Both final evaluation methods and ongoing evaluation strategies should be established.

⁶ 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

		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 of entry:
15.04.2026

Signature of course coordinator

Prof. PhD. Septimiu Crivei

Signature of seminar coordinator

Prof. PhD. Septimiu Crivei

Date of approval in the department:
23.04.2026

Signature of the head of department

Prof. PhD. Andrei Mărcuș

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.”*