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	**Computer Science**
1.5 Study cycle	**Bachelor**
1.6 Study programme / Qualification	**Artificial Intelligence**

2. Information regarding the discipline

2.1 Name of the discipline				**Algebra**			
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	**1**	2.6. Type of evaluation	**VP**	2.7 Type of discipline	**DC**
2.8 Code of the discipline	**MLE0020**						

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	28
Additional documentation (in libraries, on electronic platforms, field documentation)	14
Preparation for seminars/labs, homework, papers, portfolios and essays	28
Tutorship	10
Evaluations	14
Other activities:	0

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	
4.2. competencies	

5. Conditions (if necessary)

5.1. for the course	

5.2. for the seminar /lab activities	

6. Specific competencies acquired

Professional competencies	C3.1 Description of concepts, theories and models used in the application field C4.3 Identification of adequate models and methods for solving real problems
Transversal competencies	CT2 Efficient fulfillment of organized activities in an inter-disciplinary group and development of empathic abilities of inter-personal communication, relationship and collaboration with various groups

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

7.1 General objective of the discipline	To introduce the basic notions of linear algebra as well as some of its applications to computer science
7.2 Specific objective of the discipline	To present some applications of linear algebra to computer science

8. Content

8.1 Course	Teaching methods	Remarks
1. Functions. Equivalence relations and partitions	interactive exposure, explanation, didactical demonstration	
2. Binary operations. Groups, subgroups, group homomorphisms	interactive exposure, explanation, didactical demonstration	
3. Rings and fields, subrings and subfields, ring homomorphisms	interactive exposure, explanation, didactical demonstration	
4. Vector spaces, examples. Subspaces. Linear maps	interactive exposure, explanation, didactical demonstration	
5. Linear dependence and independence. Bases, dimension. Steinitz theorem	interactive exposure, explanation, didactical demonstration	
6. Bases and coordinates. Dimension related formulas	interactive exposure, explanation, didactical demonstration	
7. Elementary operations. Matrices and determinants	interactive exposure, explanation, didactical demonstration	
8. Rank and inverse of a matrix. Matrix of a list of vectors	interactive exposure, explanation, didactical demonstration	
9. Matrix of a linear map. Change of basis	interactive exposure, explanation, didactical demonstration	
10. Systems of linear equations, solving methods	interactive exposure, explanation, didactical demonstration	
11. Eigenvectors and eigenvalues	interactive exposure, explanation, didactical demonstration	

12. Linear codes, examples. Generator matrix and parity-check matrix	interactive exposure, explanation, didactical demonstration	
13. Decoding linear codes	interactive exposure, explanation, didactical demonstration	
14. Applications of Algebra to Computer Science	interactive exposure, explanation, didactical demonstration	

Bibliography

1. G. Calugareanu, Lectii de algebra liniara, Lito UBB, Cluj-Napoca, 1995.
2. S. Crivei, Basic linear algebra, Cluj University Press, Cluj-Napoca, 2022.
3. C. Gherghe, D. Popescu, Criptografie. Coduri. Algoritmi, Editura Univ. Bucuresti, 2005.
4. J. Gilbert, L. Gilbert, Elements of modern algebra, PWS-Kent, Boston, 1992.
5. W. J. Gilbert, W. K. Nicholson, Modern Algebra with Applications, John Wiley, 2004.
6. P. N. Klein, Coding the Matrix. Linear Algebra through Applications to Computer Science, Newtonian Press, 2013.

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Functions. Equivalence relations and partitions	interactive exposure, conversation	
2. Binary operations. Groups, subgroups, group homomorphisms	interactive exposure, conversation	
3. Rings and fields, subrings and subfields, ring homomorphisms	interactive exposure, conversation	
4. Vector spaces, examples. Subspaces. Linear maps	interactive exposure, conversation	
5. Linear dependence and independence. Bases, dimension. Steinitz theorem	interactive exposure, conversation	
6. Bases and coordinates. Dimension related formulas	interactive exposure, conversation	
7. Elementary operations. Matrices and determinants	interactive exposure, conversation	
8. Rank and inverse of a matrix. Matrix of a list of vectors	interactive exposure, conversation	
9. Matrix of a linear map. Change of basis	interactive exposure, conversation	
10. Systems of linear equations, solving methods	interactive exposure, conversation	
11. Eigenvectors and eigenvalues	interactive exposure, conversation	
12. Linear codes, examples. Generator matrix and parity-check matrix	interactive exposure, conversation	
13. Decoding linear codes	interactive exposure, conversation	
14. Applications of Algebra to Computer Science	interactive exposure, conversation	

Bibliography

1. S. Crivei, Basic linear algebra, Cluj University Press, Cluj-Napoca, 2022.
2. W. J. Gilbert, W. K. Nicholson, Modern Algebra with Applications, John Wiley, 2004.
3. P. N. Klein, Coding the Matrix. Linear Algebra through Applications to Computer Science, Newtonian Press, 2013.
4. I. Purdea, C. Pelea, Probleme de algebra, Editura EIKON, Cluj-Napoca, 2008.

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

The contents is directed towards applications of linear algebra to computer science.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Knowledge of basic concepts, examples	Exam	25
10.5 Seminar/lab	Problem solving	Exam, assessments	75
10.6 Minimum performance standards			
Grade 5			

Date
26.04.2023

Signature of course coordinator
Prof.PhD. Septimiu CRIVEI

Signature of seminar coordinator
Prof.PhD. Septimiu CRIVEI

Date of approval

Signature of the head of department
Prof.PhD. Andrei MARCUS