**SYLLABUS**

**1. Information regarding the programme**

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

**2. Information regarding the discipline**

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|---|---|---|---|---|---|---|---|
| 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 | **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 | | | | | 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 |

| | |
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| 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)

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| 4.1. curriculum | • |
| 4.2. competencies | • |

**5. Conditions** (if necessary)

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|---|---|
| 5.1. for the course | • |
| 5.2. for the seminar /lab activities | • |

**6. Specific competencies acquired**

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|---|---|
| **Professional competencies** | • C3.1 Description of concepts, theories and models used in the application field<br>• 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)

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|---|---|
| 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. Bilinear and quadratic forms. Reduction of quadratic forms to the canonical form | interactive exposure, explanation, didactical demonstration | |
| 13. Linear codes, examples. Generator matrix and parity-check matrix | interactive exposure, explanation, didactical demonstration | |
| 14. Decoding linear codes | interactive exposure, explanation, didactical demonstration | |
| Bibliography | | |

1. G. Calugareanu, Lectii de algebra liniara, Lito UBB, Cluj-Napoca, 1995.
2. S. Crivei, Basic abstract algebra, Casa Cartii de Stiinta, Cluj-Napoca, 2002, 2003.
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.

| 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. Bilinear and quadratic forms. Reduction of quadratic forms to the canonical form | interactive exposure, conversation | |
| 13. Linear codes, examples. Generator matrix and parity-check matrix | interactive exposure, conversation | |
| 14. Decoding linear codes | interactive exposure, conversation | |

Bibliography

1. N. Both, S. Crivei, Culegere de probleme de algebra, Lito UBB Cluj-Napoca, 1996.
2. S. Crivei, Basic abstract algebra, Casa Cartii de Stiinta, Cluj-Napoca, 2002, 2003.
3. 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 | Test, exam, assessments | 75 |
| 10.6 Minimum performance standards | | | |
| ➢ Grade 5 | | | |

| Date | Signature of course coordinator | Signature of seminar coordinator |
|---|---|---|
| 30.04.2016 | Prof.PhD. Septimiu CRIVEI | Prof.PhD. Septimiu CRIVEI |
| Date of approval | | Signature of the head of department |
| | | Prof.PhD. Octavian AGRATINI |