**SYLLABUS**

**Academic year 2021-2022**

**Year of study I / Semester I**

**1. Information on academic programme**

| | |
|---|---|
| 1.1. University | **„1 Decembrie 1918" from Alba Iulia** |
| 1.2. Faculty | **Faculty Of Exact Sciences and Engineering** |
| 1.3. Department | **Informatics, Mathematics and Electronics Department** |
| 1.4. Field of Study | **Computer Science** |
| 1.5. Cycle of Study | **Undergraduate** |
| 1.6. Academic programme / Qualification | **Computer Science** / **251201, 251203, 251204** |

**2. Information of Course Matter**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1. Course | ***Linear algebra, analytic and differential geometry*** | | | 2.2. Code | | **CSE104** | |
| 2.3. Course Leader | | | Dr. Dorin Wainberg | | | | |
| 2.4. Seminar Tutor | | | Dr. Dorin Wainberg | | | | |
| 2.5. Academic Year | **I** | 2.6. Semester | **I** | 2.7. Type of Evaluation (E – final exam/ CE - colloquy examination / CA - continuous assessment) | **E** | 2.8. Type of course (C– Compulsory, Op – optional, F - Facultative) | **C** |

**3. Course Structure (Weekly number of hours)**

| | | | | | |
|---|---|---|---|---|---|
| 3.1. Weekly number of hours | **4** | 3.2. course | **2** | 3.3. seminar, laboratory | **2** |
| 3.4. Total number of hours in the curriculum | **56** | 3.5. course | **28** | 3.6. seminar, laboratory | **28** |
| Allocation of time: | | | | | hours |
| Individual study of readers | | | | | **20** |
| Documentation (library) | | | | | **20** |
| Home assignments, Essays, Portfolios | | | | | **27** |
| Tutorials | | | | | **-** |
| Assessment (examinations) | | | | | **2** |
| Other activities……. | | | | | **-** |

| | |
|---|---|
| 3.7 Total number of hours for individual study | 69 |
| 3.9 Total number of hours per semester | 69+56=125 |
| 3.10 Number of ECTS | 5 |

**4. Prerequisites (where applicable)**

| | |
|---|---|
| 4.1. curriculum-based | - |
| 4.2. competence-based | - |

**5. Requisites (where applicable)**

| | |
|---|---|
| 5.1. course-related | Room equipped with video projector / board |
| 5.2. seminar/laboratory-based | Room equipped with board |

**6. Specific competences to be acquired**

| | |
|---|---|
| Professional competences | C4.1 Defining the basic concepts and principles of the professional field, as well as mathematical theories and models.<br>C4.2 Interpretation of mathematical and computer model.<br>C4.3 Identify appropriate models and methods for solving real problems.<br>C4.4 Using simulation to study the behavior of the models and evaluate performance.<br>C4.5 Incorporation of formal models in specific applications in various fields. |
| Transversal competences | - |

**7. Course objectives (**as per the programme specific competences grid)

| | |
|---|---|
| 7.1 General objectives of the course | This course is designed to introduce students to various topics in algebra and geometry that they will encounter in Computer Science theory. The concepts are illustrated with actual examples from the specialized literature. Exercises are designed to encourage the student to begin thinking about mathematics within a theoretical context. |
| 7.2 Specific objectives of the course | - To understand several important concepts in linear algebra, including systems of linear equations and their solutions; matrices and their properties; determinants and their properties; vector spaces; linear independence of vectors; subspaces, bases, and dimension of vector spaces; inner product spaces; linear transformations; and eigenvalues and eigenvectors;<br>- to apply these concepts to such real informatics phenomena as networks and computer programming.<br>- to improve the ability (or to learn) to prove mathematical theorems;<br>- to improve your ability to think logically, analytically, and abstractly;<br>- to improve your ability to communicate mathematics, both orally and in writing. |

**8. Course contents**

| **8.1 Course (learning units)** | **Teaching methods** | **Remarks** |
|---|---|---|
| 1. Matrix: definition, operations and properties. Splitting a matrix into a submatrix (blocks). | *Lecture, conversation* | **2** |
| 2. The determinant of a matrix. Inverse matrix. The rank of a matrix. | *Lecture, conversation* | **2** |
| 3. Systems of linear equations. Cramer type systems. | *Lecture, conversation* | **2** |
| 4. Compatibility of linear equations systems. Partial elimination method (Gauss). Total elimination method (Gauss-Jordan). | *Lecture, conversation* | **2** |
| 5. Composition laws. Algebraic structures with internal composition laws: monoids, groups, rings. | *Lecture, conversation* | **2** |
| 6. Vector spaces. Linear dependence and linear independence. | *Lecture, conversation* | **2** |
| 7. Generator system. Bases. The dimension of a vector space. | *Lecture, conversation* | **2** |
| 8. Real vector spaces with scalar product. Orthogonality. | *Lecture, conversation* | **2** |
| 9. Linear applications. The kernel and image of a linear application. | *Lecture, conversation* | **2** |
| 10. Right in the plan. | *Lecture, conversation* | **2** |
| 11. Conics. Circle, ellipse, parabola, hyperbola. | *Lecture, conversation* | **2** |
| 12. Coordinate systems in space. The plan. Lines in space. | *Lecture, conversation* | **2** |
| 13. Plain curves. Tangent and normal to a flat curve. The curvature of a plane curve. | *Lecture, conversation* | **2** |
| 14. Curves in space. The tangent plane and the normal plane to a curve in space. The curvature and torsion of a curve in space. | *Lecture, conversation* | **2** |

**References**

1. Leon, L., *Linear algebra with application*, Ed. Pearson, 2014.
2. McCrea, W., Analytical Geometry of Three Dimensions, Dover publications, 2015.
3. Sochi, T., Introduction to Differential Geometry of Space Curves and Surfaces, Independently published, 2014
4. Cimpean, D., Inoan, I., *An Invitation to Linear Algebra and Analytic Geometry*, Editura Mediamira, Cluj-Napoca, 2009.
5. Andrica, D., Topan**,** L**.** *Analytic Geometry*, Cluj University Press, 2004.

| **Seminars-laboratories** | Teaching methods | |
|---|---|---|

| | | |
|---|---|---|
| 1. Matrix: definition, operations and properties. Splitting a matrix into a submatrix (blocks). | *Exercises and problems* | 2 |
| 2. The determinant of a matrix. Inverse matrix. The rank of a matrix. | *Exercises and problems* | 2 |
| 3. Systems of linear equations. Cramer type systems. | *Exercises and problems* | 2 |
| 4. Compatibility of linear equations systems. Partial elimination method (Gauss). Total elimination method (Gauss-Jordan). | *Exercises and problems* | 2 |
| 5. Composition laws. Algebraic structures with internal composition laws: monoids, groups, rings. | *Exercises and problems* | 2 |
| 6. Vector spaces. Linear dependence and linear independence. | *Exercises and problems* | 2 |
| 7. Generator system. Bases. The dimension of a vector space. | *Exercises and problems* | 2 |
| 8. Real vector spaces with scalar product. Orthogonality. | *Exercises and problems* | 2 |
| 9. Linear applications. The kernel and image of a linear application. | *Exercises and problems* | 2 |
| 10. Right in the plan. | *Exercises and problems* | 2 |
| 11. Conics. Circle, ellipse, parabola, hyperbola. | *Exercises and problems* | 2 |
| 12. Coordinate systems in space. The plan. Lines in space. | *Exercises and problems* | 2 |
| 13. Plain curves. Tangent and normal to a flat curve. The curvature of a plane curve. | *Exercises and problems* | 2 |
| 14. Curves in space. The tangent plane and the normal plane to a curve in space. The curvature and torsion of a curve in space. | *Exercises and problems* | 2 |

**References**


1. Leon, L., *Linear algebra with application*, Ed. Pearson, 2014.
2. McCrea, W., Analytical Geometry of Three Dimensions, Dover publications, 2015.
3. Sochi, T., Introduction to Differential Geometry of Space Curves and Surfaces, Independently published, 2014
4. Cimpean, D., Inoan, I., *An Invitation to Linear Algebra and Analytic Geometry*, Editura Mediamira, Cluj-Napoca, 2009.
5. Andrica, D., Topan, L. *Analytic Geometry*, Cluj University Press, 2004.


**9. Corroboration of course contents with the expectations of the epistemic community's significant representatives, professional associations and employers in the field**

*The accumulation by students of knowledge related to this discipline requires their preparation for the labor market, so that they can solve the problems that arise in practice by creating appropriate mathematical models.*

**10. Assessment**

| Activity | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of final grade |
|---|---|---|---|
| 10.4 Course | *Final evaluation* | *Written paper* | 50% |
| 10.5 Seminar/laboratory | *Continuous assessment* | *Tests during the semester* | 50% |
| 10.6 Minimum performance standard: Modelling and solving some medium complexity level problems, using the mathematical and computer sciences knowledge. | | | |

Submission date　　　Course leader signature　　　Seminar tutor signature

Date of approval by Department members　　　Department director signature