SYLLABUS

Academic year 2024-2025

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 Informatics and Engeneering**
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** **ESCO-08: Software developers** **Analyst 251201** **Computer System Programmer 251204** **Computer System Engineer 251203**

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)	**CE**	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	**25**
Documentation (library)	**25**
Home assignments, Essays, Portfolios	**17**
Tutorials	**-**
Assessment (examinations)	**2**
Other activities…….	**-**

3.7 Total number of hours for individual study	69
3.8 Total number of hours according to the curricula	56
3.9 Total number of hours per semester	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	- CP13 (1 ECTS), CP25 (1 ECTS), CP27 (1 ECTS), CP32 (1 ECTS), CP35 (1 ECTS)
Transversal competences	Not applicable

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; - to apply these concepts to such real informatics phenomena as networks and computer programming. - to improve the ability (or to learn) to prove mathematical theorems; - to improve your ability to think logically, analytically, and abstractly; - 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. The determinant of a matrix. Inverse matrix. The rank of a matrix.	*Lecture, conversation*	
3. Systems of linear equations. Cramer type systems.	*Lecture, conversation*	
4. Compatibility of linear equations systems. Partial elimination method (Gauss). Total elimination method (Gauss-Jordan).	*Lecture, conversation*	
5. Composition laws. Algebraic structures with internal composition laws: monoids, groups, rings.	*Lecture, conversation*	
6. Vector spaces. Linear dependence and linear independence.	*Lecture, conversation*	
7. Generator system. Bases. The dimension of a vector space.	*Lecture, conversation*	
8. Real vector spaces with scalar product. Orthogonality.	*Lecture, conversation*	
9. Linear applications. The kernel and image of a linear application.	*Lecture, conversation*	
10. Right in the plan.	*Lecture, conversation*	
11. Conics. Circle, ellipse, parabola, hyperbola.	*Lecture, conversation*	
12. Coordinate systems in space. The plan. Lines in space.	*Lecture, conversation*	
13. Plain curves. Tangent and normal to a flat curve. The curvature of a plane curve.	*Lecture, conversation*	
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*	

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

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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

Date of approval by Faculty councile | Dean signature