SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Mathematics
1.4 Field of study	Electronic Engineering, Telecommunications and Information Technologies
1.5 Cycle of study	Bachelor of Science
1.6 Program of study / Qualification	Telecommunications Technologies and Systems/ Engineer Applied Electronics/Engineer
1.7 Form of education	Full time
1.8 Subject code	TST-E02.00/EA-E02.00

2. Data about the subject

2.1 Subject name	Linear Algebra and Analytical and Differential Geometry						
2.2 Subject area	Theoretical area Methodological area Analytic area						
2.3 Course responsible	Prof. Radu PETER, Ph.D. - ioan.radu.peter@math.utcluj.ro						
2.4 Teacher in charge with seminar / laboratory / project	Assist. Liana TIMBOS, Ph.D. - liana.timbos@math.utcluj.ro						
2.5 Year of study	1	2.6 Semester	1	2.7 Assessment	E	2.8 Subject category	DF/DI

3. Estimated total time

3.1 Number of hours per week	4	of which: 3.2 course	2	3.3 seminar / laboratory	2
3.4 To Total hours in the curriculum	56	of which: 3.5 course	28	3.6 seminar / laboratory	28

Distribution of time	hours
Manual, lecture material and notes, bibliography	30
Supplementary study in the library, online specialized platforms and in the field	5
Preparation for seminars / laboratories, homework, reports, portfolios and essays	28
Tutoring	3
Exams and tests	3
Other activities:	

3.7 Total hours of individual study	69
3.8 Total hours per semester	125
3.9 Number of credit points	5

4. Pre-requisites (where appropriate)

4.1 curriculum	N/A
4.2 competence	N/A

5. Requirements (where appropriate)

5.1. for the course	
5.2. for the seminars / laboratories / projects	

6. Specific competences

Professional competences	C1. Use of the fundamental elements related to devices, circuits, systems, instrumentation and electronic technology C2. Applying the basic methods for the acquisition and processing of signals C3. Application of the basic knowledge, concepts and methods regarding the architecture of computer systems, microprocessors, microcontrollers, languages and programming techniques
Transversal competences	N/A

7. Discipline objectives (as results from the key competences gained)

7.1 General objective	Knowledge of algebra, geometry and their applications. Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions
7.2 Specific objectives	Understanding linear algebra, vector spaces and related topics.

8. Contents

8.1 Lecture (syllabus)	Teaching methods	Notes
1. Linear spaces. Definition. Linear subspaces. Examples.		
2. Linear independence. Basis. Dimension. Change of basis.		
3. Inner - product spaces. Definition, properties, Schwarz' inequality. Examples		
4. Linear transformations. Definition, elementary properties, Kernel and Image.		
5. The matrix associated to a linear transformation. The standard construction. Expresions in terms of coordinates.		
6. Eigenvalues and eigenvectors. Definitions, invariant subspaces, characteristic polynomials.		
7. The diagonal form. Canonical forms, diagonalizability.		
8. The Jordan canonical form. Construction of a Jordan basis and a Jordan matrix.		
9. Functions of a matrix. The n-th power of a matrix. Elementary functions of a matrix.		
10. The adjoint operator. Definition, properties, examples.		
11. Self-adjoint operators, unitary operators, properties of the eigenvalues and eigenvectors.		
12. Bilinear forms, quadratic forms. The associated matrix.		
13. The canonical form. Reduction to a canonical form. The method of eigenvalues and Jacobi's method.		
14. Conics and quadrics. Reduction to a canonical form. Geometric properties.		

Bibliography 1. https://algappl.utcluj.ro/		
8.2 Seminar / laboratory / project	Teaching methods	Notes
1. Determinants, matrices, geometric vectors		
2. Linear spaces, bases, dimension		
3. Inner-product spaces		
4. Linear transformations. Examples		
5. Linear transformations characterized in terms of matrices		
6. Invariant subspaces, eigenvalues, eigenvectors		
7. Diagonalizable linear transformations		
8. Jordan bases, Jordan canonical forms		
9. Elementary functions of a matrix, examples		
10. The adjoint operator		
11. Special classes of operators		
12. Bilinear forms, quadratic forms		
13. Reduction to a canonical form		
14. Conics and quadrics, reduction to a canonical form		
Bibliography 1. https://algappl.utcluj.ro/		

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

The discipline content and the acquired skills are in agreement with the expectations of the professional Competences acquired will be used in the following COR occupations (Electronics Engineer; Telecommunications Engineer; Electronics Design Engineer; System and Computer Design Engineer; Communications Design Engineer) or in the new occupations proposed to be included in COR (Sale Support Engineer; Multimedia Applications Developer; Network Engineer; Communications Systems Test Engineer; Project Manager; Traffic Engineer; Communications Systems Consultant).

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The level of acquired theoretical knowledge and practical skills	Written exam	80%
10.5 Seminar/ Laboratory	The level of acquired knowledge and abilities	Verification through laboratory tests	20%
10.6 Minimum standard of performance			
✓ M>5			

Date of filling in:	Responsible	Title First name SURNAME	Signature
16.06.2025	Course	Prof. Radu PETER, Ph.D.	
	Applications	Assist. Liana TIMBOS, Ph.D.	

Date of approval in the Council of the Communications Department 18.06.2025	Head of Communications Department Prof. Virgil DOBROTA, Ph.D.
Date of approval in the Council of the Faculty of Electronics, Telecommunications, and Information Technology 25.06.2025	Dean Prof. Ovidiu POP, Ph.D.