SYLLABUS

1. Program information

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Bases of Electronics
1.4 Field of study	Electronic engineering, telecommunications and information technologies
1.5 Cycle of study	Bachelor of Science
1.6 Study program / Qualification	Electronic engineering, telecommunications and information technologies/ Engineer
1.7 Form of education	IF – full-time education

2. Course information

2.1 Course title	Linear Algebra and Analytic and Differential Geometry					Course code	2.00
2.2 Course coordinator	*Lecturer PhD Liana Timboș – liana.timbos@math.utcluj.ro*						
2.3 Seminar/ laboratory/ project/ practical activity coordinator	*Lecturer PhD Liana Timboș – liana.timbos@math.utcluj.ro*						
2.4 Year of study	I	2.5 Semester	1	2.6 Type of assessment			E
2.7 Course status	Formative category						DF
	Optionality						DOB

3. Estimated total time

3.1 Hours per week	4	of which:	3.2 Lecture	2	3.3 Seminar	2	3.3 Laboratory	0	3.3 Project	0	3.3 Practical training	0
3.4 Hours per semester	56	of which:	3.5 Lecture	28	3.6 Seminar	28	3.6 Laboratory	0	3.6 Project	0	3.3 Practical training	0

3.7 Time distribution (hours per semester) for individual study and assessment:	
(a) Assessment	
(b) Study using textbook, course materials, bibliography, and notes	34
(c) Additional documentation in the library, on specialized electronic platforms, and in the field	6
(d) Preparation for seminars/laboratories, assignments, reports, portfolios and essays	26
(e) Tutoring	0
(f) Other activities	3
3.8 Total hours of individual study and assessment (sum of (3.7(a)...3.7(f))	69
3.9 Total hours per semester (3.4+3.8)	125
3.10 Number of credits	5.0

4. Prerequisites (where applicable)

4.1 curriculum	Basic knowledge of Linear Algebra and Analytic Geometry
4.2 competencies	Competences in elementary Linear Algebra and Analytic Geometry: matrices, determinants, linear systems, vectors and lines in plane

5. Requirements (where applicable)

5.1. for the development of the lecture	Blackboard, video projector
5.2. for the development of the seminar/ laboratory/ project	Blackboard, video projector

6. Specific competencies acquired

Professional competencies	C1. Use of the fundamental elements related to devices, circuits, systems, instrumentation and electronic technology C1.2 Analysis of electronic circuits and systems of low/ medium complexity, for the purpose of designing and measuring them C1.5 Design and implementation of electronic circuits of low/ medium complexity using CADCAM technologies and standards in the field C2. Applying the basic methods for the acquisition and processing of signals C2.1 Temporal, spectral and statistical characterization of signals C2.4 Use of specific methods and tools for signal analysis C3. Application of the basic knowledge, concepts and methods regarding the architecture of computer systems, microprocessors, microcontrollers, languages and programming C3.3 Solving concrete practical problems including elements of data structures and algorithms, programming and use of microprocessors or microcontrollers C3.4 Elaboration of programs in a general and/ or specific programming language, starting from the specification of the requirements to the execution, debugging and interpretation of the results in correlation with the processor used. C3.5 Development of projects involving hardware components (processors) and software components (programming)
Transversal competencie	

7. Expected learning outcomes

Knowledge	- The student/graduate identifies and describes basic concepts, principles and methods in mathematics, physics, chemistry, technical drawing, economics and computer science.
Skills	- The student/graduate solves mathematics, physics and chemistry problems with engineering applicability and validates the solution obtained.
Responsibility and autonomy	- The student/graduate applies the values of ethics and professional deontology specific to the engineering profession. - The student/graduate applies logical reasoning, evaluation and self-assessment in decision-making. - The student/graduate communicates effectively about engineering activities with a wide range of audiences. - The student/graduate is engaged in lifelong learning in order to acquire and implement knowledge, as needed, using appropriate learning strategies. - The student/graduate promotes dialogue, cooperation, respect for others and interculturality. - The student/graduate works effectively as a team member or as a team leader. - The student/graduate fluently uses at least one international language in technical communication.

8. Course objectives (based on the grid of specific competencies acquired)

8.1 General objective of the course	A presentation of the concepts, notions, methods and fundamental techniques used in linear algebra and analytic geometry.
8.2 Specific objectives	Use of the matrix calculus (in the general context of linear algebra) in order to solve problems in engineering. Use of the vectorial calculus (in the general context of analytic geometry) in modelling and solving practical problems concerning spatial forms.

9. Contents

9.1 Lecture	**No. of hours**	**Teaching methods**	**Remarks**
Vectors in plane and space.	2	Explanation, Demonstration, Collaboration, Interactive activities	
Lines and planes	4		
Vector spaces: definition, examples, subspaces, sums of subspaces.	2		
Basis and dimensions. Linear independence. Change of basis.	2		
Inner product spaces (I): definition, examples, computations, orthonormal basis, Schwarz inequality, orthogonal complement.	2		
Inner product spaces (II): Gram determinants. Linear manifolds, distances.	2		
Linear maps (I): definition, kernel, image, injective and surjective maps.	2		

9.1 Lecture	No. of hours	Teaching methods	Remarks
Linear maps (II): the matrix of a linear map.	2		
Eigenvectors and eigenvalues of operators (and associated matrix).	2		
Characteristic polynomial. Cayley-Hamilton theorem. Diagonal form. Diagonalizable operators. The n-th power of a matrix.	2		
The Jordan canonical form for operators (and associated matrix). Jordan basis, the Jordan matrix.	2		
Conic sections. Reduction to a canonical form. Geometric properties.	4		
Bibliography 1. D. Cimpean, D. Inoan, I. Rasa, An invitation to Linear Algebra and Analytic Geometry, Ed. Mediamira, 2012 2. I.R. Peter, S. Laszlo, A. Viorel, Elements of Linear Algebra, Mediamira 2014, https://algappl.utcluj.ro/ 3. V. Pop, I. Rasa, Linear Algebra with Applications to Markov Chains, Ed. Mediamira, 2005 4. L. Timboş, "Linear Algebra, Analytic and Differential Geometry - Theory and seminar problems", UTPress, 2023, https://algappl.utcluj.ro/			

9.2 Seminar /laboratory /project /practical training	No. of hours	Teaching methods	Remarks
Linear systems, matrices, determinants.	2	Explanation, Demonstration, Collaboration, Interactive activities	
Vectors in space.	2		
Problems in analytical geometry: lines and planes. Applications.	4		
Linear spaces, basis, dimension.	4		
Inner product spaces, orthonormal basis, Gram-Schmidt orthogonalization process, orthogonal complement.	2		
Gram determinants. Linear manifolds, distances.	2		
Linear maps: kernel, image, the matrix of a linear map. Applications.	2		
Eigenvalues and eigenvectors. Diagonalizable linear maps.	3		
Jordan canonical form, Jordan basis.	3		
Conic sections - reduction to a canonical form.	2		
Recapitulative problems.	2		
Bibliography 1. D. Cimpean, D. Inoan, I. Rasa, An invitation to Linear Algebra and Analytic Geometry, Ed. Mediamira, 2012 2. I.R. Peter, S. Laszlo, A. Viorel, Elements of Linear Algebra, Mediamira 2014, https://algappl.utcluj.ro/ 3. V. Pop, I. Rasa, Linear Algebra with Applications to Markov Chains, Ed. Mediamira, 2005 4. L. Timboş, "Linear Algebra, Analytic and Differential Geometry - Theory and seminar problems", UTPress, 2023, https://algappl.utcluj.ro/			

10. Alignment of the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The course content and the teaching-learning-assessment methods are aligned with the current requirements of the Electronics, Telecommunications, and Information Technology Engineering field, considering the expectations of the academic and professional community, representative employers, as well as the national quality assurance standards in higher education. The course helps prepare students in line with employer expectations and the quality requirements set for engineering study programs.

11. Assessment

Activity type	**11.1 Assessment criteria**	**11.2 Assessment methods** (and type of assessment: continuous/ summative)	**11.3 Weight in final grade**
11.4 Lecture	Ability of understanding and using the concepts creatively and proofs	Written exam and oral exam	80%
11.5 Seminar/ Laboratory/ Project /Practical activity	Abilities to solve problems and applying algorithms	Problem-solving throughout the semester	20%
11.6 Minimum performance standard • Participation in the exam is conditioned by attendance at seminars - minimum 75% of seminary lessons • exam mark **E** must be at least 5, **E = 0.4 W + 0.4 O + 0.1 SA + 0.1 A** W – grade for the written paper, O – grade for the oral exam, SA – seminar and course activity, A – grade for assignments/test			

Completion date:	**Course coordinators**	**teaching rank, title First name LAST NAME**	**Signature**
23.06.2026	Lecture	*Lecturer, PhD Liana TIMBOȘ*	
	Applications	*Lecturer, PhD Liana TIMBOȘ*	

Approval of the Head of the Department coordinating the course, only if this differs from the department organizing the study program	Head of the Mathematics Department Prof. Vasile Dorian POPA, Ph.D.

Date of approval by the Council of the Department of Bases of Electronics 26.06.2026	Head of the Bases of Electronics Department Prof. Sorin HINTEA, Ph.D.
Date of approval by the Council of the Faculty of Electronics, Telecommunications and Information Technology 30.06.2026	Dean, Prof. Ovidiu-Aurel POP, Ph.D.