SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Automation and Computer Science
1.3	Department	Automation
1.4	Field of study	Automation. Applied Informatics and Intelligent Systems
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Automation and Applied Informatics (English)
1.7	Form of education	Full time
1.8	Subject code	2.00

2. Data about the subject

2.1	Subject name					Linear Algebra					
2.2	Subject area					Computer Science and Information Technology					
2.3	Course responsible/lecturer					Prof. dr. Ioan Radu Peter ioan.radu.peter@math.utcluj.ro					
2.4	Teachers in charge of applications					Conf. dr. Dalia Cimpean Dalia.Cimpean@math.utcluj.ro					
2.5	Year of study	I	2.6	Semester	1	2.7	Assessment	Written /online exam	2.8	Subject category	DF/OB

3. Estimated total time

Sem.	Subject name	Lecture	Applications			Lecture	Applications			Individual study	TOTAL	Credit
		[hours / week.]				[hours / semester]						
			S	L	P		S	L	P			
1	**Linear Algebra**	**2**	**2**	**-**	**-**	**28**	**28**	**-**	**-**	**48**	**104**	**4**

3.1	Number of hours per week	4	3.2	of which, course	2	3.3	applications	2
3.4	Total hours in the teaching plan	104	3.5	of which, course	28	3.6	applications	28

Individual study	Hours
Manual, lecture material and notes, bibliography	20
Supplementary study in the library, online and in the field	4
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	21
Tutoring	0
Exams and tests	3
Other activities	0

3.7	Total hours of individual study	48
3.8	Total hours per semester	104
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

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

5. Requirements (where appropriate)

5.1	For the course	Blackboard, videoprojector
5.2	For the applications	Blackboard, videoprojector

6. Specific competences

Professional competences	**C1 –** Operating with basic Mathematical, Engineering and Computer Science concepts **C1.1 –** Recognizing and describing concepts that are specific to the fields of calculability, complexity, programming paradigms, and modeling computational and communication systems **C1.3 –** Building models for various components of computing systems **C1.5 –** Providing a theoretical background for the characteristics of the designed systems

Cross competences	N/A

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

7.1	General objective	A presentation of the concepts, notions, methods and fundamental techniques used in linear algebra and analytic geometry.
7.2	Specific objectives	Use of the matriceal 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.

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Linear spaces. Definition. Linear subspaces. Examples.	Explanation Demonstration Collaboration Interactive activities	
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. D. Cimpean, D. Inoan, I. Rasa, An invitation to Linear Algebra and Analytic Geometry, Ed. Mediamira, 2012
2. V. Pop, I. Rasa, Linear Algebra with Applications to Markov Chains, Ed. Mediamira, 2005

8.2. Applications (Seminars)		Teaching methods	Notes
1	Determinants, matrices, geometric vectors	Explanation Demonstration Collaboration Interactive activities	
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. D. Cimpean, D. Inoan, I. Rasa, An invitation to Linear Algebra and Analytic Geometry, Ed. Mediamira, 2012
2. V. Pop, I. Corovei, Algebra pentru ingineri. Culegere de probleme, Ed. Mediamira, 2003.

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

Collaboration with engineers in order to identify and solve problems raised by the market.

10. Evaluation

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		Abilities of understanding and using creatively the concepts and proofs		Written examination		30%
Applications		Abilities of solving problems and applying algorithms		Written examination		70%
10.4 Minimum standard of performance						
Ability to present coherently a theoretical subject and to solve problems with practical content.						

Date of filling in	Course responsible	Teachers in charge of applications
15.02.2025	Prof. dr. Ioan Radu Peter	Conf. dr. Dalia Cimpean

Date of approval by the Department Board Automation	Head of Departament Prof.dr.ing. Honoriu VĂLEAN
Date of approval by the Faculty Council Automation and Computer Science	Dean Prof.dr.ing. Vlad MUREȘAN