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	Mathematics
1.4	Field of study	Electronics and Telecommunications Engineering
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						
2.2	Subject area					Mathematics						
2.3	Course responsible/lecturer					Assoc. Prof. Ioan Radu Peter						
2.4	Teachers in charge of applications					Assoc. Prof. Ioan Radu Peter						
2.5	Year of study	I	2.6	Semester	1	2.7	Assessment	Exam	2.8	Subject category	DF/DOB	

3. Estimated total time

Year / Sem.	Subject name	No. of weeks	Course	Applications			Course	Applications			Indiv. study	TOTAL	Credits
			[hours/week]				[hours/sem.]						
				S	L	P		S	L	P			
II / 1	Linear Algebra	14	2		2		28		28		74	130	5

3.1	Number of hours per week	4	3.2	of which, course	2	3.3	applications	2
3.4	Total hours in the curriculum	56	3.5	of which, course	28	3.6	applications	28

Individual study	Hours
Manual, lecture material and notes, bibliography	40
Supplementary study in the library, online and in the field	-
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	28
Tutoring	3
Exams and tests	3
Other activities	0

3.7	Total hours of individual study	74
3.8	Total hours per semester	130
3.9	Number of credit points	5

4. Pre-requisites (where appropriate)

4.1	Curriculum	Basics of linear algebra and analytic geometry (romanian high school level, specialization mathematics and informatics)

4.2	Competence	Competence related to subjects above

5. Requirements (where appropriate)

5.1	For the course	Amphitheatre, Cluj-Napoca
5.2	For the applications	Cluj-Napoca

6. Specific competences

Professional competences	Theoretical knowledge (what the student must know):	Descriptions and recognition of some specific concepts of analytic geometry, vectors operations, their meaning. Descriptions and recognition of some specific concepts of linear algebra, their meaning and problem solving skills. Descriptions and recognition of some specific concepts of some simple aplications in pattern recognition, machine learning folosind metode algebrice
	Acquired skills (what the student is able to do):	- Uses of theoretical aspects in problem solving.
	Acquired abilities: (what type of equipment the student is able to handle)	The student can operate and understand some topics in analytical geometry and linear algebra. He is prepared for understanding basics in pattern recognition, machine leraning and primary notions in computer vision.
	In accordance with Grila1 and Grila2 RNCIS	C1. To use the fundamental elements regarding electronic devices, circuits, systems, instrumentation and technology C2. To apply basic methods for signal acquisition and processing C3. To apply knowledge, concepts and basic methods regarding computing systems' architecture, microprocessors, microcontrollers, programming languages and techniques
Cross competences (Grila1 and Grila2 RNCIS)		N.A.

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

7.1	General objectives	Preparing the ability to use analytical geometry and linear algebra in some engineering fields.
7.2	Specific objectives	1. Using the matrix calculus (in the more general context of linear algebra and analytical geometry) to solve some specific problems in engineering.

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Linear spaces. Definition. Linear subspaces. Examples.	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .ppt presentation, projector, blackboard
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.		

8.2. Applications (seminar)		Teaching methods	Notes
1	Determinants, matrices, geometric vectors	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, computers, white/magnetic board
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. Ioan Radu Peter, Laszlo Szilard Csaba, Adrian Viorel, Elements of Linear Algebra, , U.T. Press, Cluj-Napoca, 2014, ISBN 978-973-662-935-8, http://algappl.utcluj.ro/
2. S. Axler, Linear algebra done right, second edition, Springer, 1997
3. V. Pop, I. Rasa, Linear Algebra with Applications to Markov Chains, Ed. Mediamira, 2005
4. Gh. Sabac, Matematici speciale, E.D.P. , Bucuresti, 1981

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 organizations and the employers in the field, where the students carry out the internship stages and/or occupy a job, and the expectations of the national organization for quality assurance (ARACIS).

10. Evaluations

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
Course	The level of acquired theoretical knowledge and practical skills	exam	T=30% of the pts
Applications	The level of acquired abilities	exam	P= 70% of pts
10.4 Minimum standard of performance			
0.3T+0.7Pr			

Date of filling in
19.01.2015

Course responsible
Assoc. Prof. Ioan Radu PETER, PhD

Teachers in charge of applications
Assoc. Prof. Ioan Radu PETER, PhD

Date of approval in the department
19.01.2015

Head of department
Prof. Mircea IVAN, PhD