SYLLABUS

1. Data about the program of study

1.1 Institution	The Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Automation and Computer Science
1.3 Department	Computer Science
1.4 Field of study	Computer Science and Information Technology
1.5 Cycle of study	Bachelor of Science
1.6 Program of study/Qualification	Computer science/ Engineer
1.7 Form of education	Full time
1.8 Subject code	2.

2. Data about the subject

2.1 Subject name				***Linear Algebra***	
2.2 Course responsible/lecturer				Prof. dr. Ioan Radu Peter ioan.radu.peter@math.utcluj.ro	
2.3 Teachers in charge of seminars/ laboratory/ project				Conf. dr. Dalia Cimpean Dalia.Cimpean@math.utcluj.ro	
2.4 Year of study	I	2.5 Semester	1	2.6 Type of assessment (E - exam, C - colloquium, V - verification)	E
2.7 Subject category	*DF – fundamentală, DD – în domeniu, DS – de specialitate, DC – complementară*				DF
	DI – Impusă, DOp – opțională, DFac – facultativă				DD

3. Estimated total time

3.1 Number of hours per week	4	of which:	Course	2	Seminars	2	Laboratory		Project	
3.2 Number of hours per semester	56	of which:	Course	28	Seminars	28	Laboratory		Project	
3.3 Individual study:										
(a) Manual, lecture material and notes, bibliography										20
(b) Supplementary study in the library, online and in the field										4
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										17
(d) Tutoring										
(e) Exams and tests										3
(f) Other activities:										0

3.4 Total hours of individual study (suma (3.3(a)…3.3(f)))	44
3.5 Total hours per semester (3.2+3.4)	100
3.6 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 competence

6.1 Professional competences	**C1 –** Operating with basic Mathematical, Engineering and Computer Science concepts **C1.1 -** Recognizing and describing specific concepts to calculability, complexity, programming paradigms and modeling of computing and communication systems **C1.2 -** Using specific theories and tools (algorithms, schemes, models, protocols, etc.) for explaining the structure and the functioning of hardware,

	software and communication systems **C1.3 -** Building models for various components of computing systems **C1.4 -** Formal evaluation of the functional and non-functional characteristics of computing systems **C1.5 -** Providing theoretical background for the characteristics of the designed systems
6.2 Cross competences	N/A

7. Discipline objective (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 Lectures	Hours	Teaching methods	Notes
Linear spaces. Definition. Linear subspaces. Examples.	2	Explanation Demonstration Collaboration Interactive activities	
Linear independence. Basis. Dimension. Change of basis.	2		
Inner - product spaces. Definition, properties, Schwarz' inequality. Examples	2		
Linear transformations. Definition, elementary properties, Kernel and Image.	2		
The matrix associated to a linear transformation. The standard construction. Expresions in terms of coordinates.	2		
Eigenvalues and eigenvectors. Definitions, invariant subspaces, characteristic polynomials.	2		
The diagonal form. Canonical forms, diagonalizability.	2		
The Jordan canonical form. Construction of a Jordan basis and a Jordan matrix.	2		
Functions of a matrix. The n-th power of a matrix. Elementary functions of a matrix.	2		
The adjoint operator. Definition, properties, examples.	2		
Self-adjoint operators, unitary operators, properties of the eigenvalues and eigenvectors.	2		
Bilinear forms, quadratic forms. The associated matrix.	2		
The canonical form. Reduction to a canonical form. The method of eigenvalues and Jacobi's method.	2		
Conics and quadrics. Reduction to a canonical form. Geometric properties.	2		

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/Laboratory/Project	Hours	Teaching methods	Notes
Determinants, matrices, geometric vectors	2	Explanation Demonstration Collaboration Interactive activities	
Linear spaces, bases, dimension	2		
Inner-product spaces	2		
Linear transformations. Examples	2		
Linear transformations characterized in terms of matrices	2		
Invariant subspaces, eigenvalues, eigenvectors	2		
Diagonalizable linear transformations	2		
Jordan bases, Jordan canonical forms	2		
Elementary functions of a matrix, examples	2		
The adjoint operator	2		
Special classes of operators	2		

Bilinear forms, quadratic forms	2		
Reduction to a canonical form	2		
Conics and quadrics, reduction to a canonical form	2		

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.

** Se vor preciza, după caz: tematica seminariilor, lucrările de laborator, tematica și etapele proiectului.*

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	Assessment criteria	Assessment methods	Weight in the final grade
Course	Abilities of understanding and using creatively the concepts and proofs	Written examination	30%
Seminar	Abilities of solving problems and applying algorithms	Written examination	70%
Laboratory			
Project			

Minimum standard of performance:
Ability to present coherently a theoretical subject and to solve problems with practical content.

Date of filling in:	**Titulari**	**Titlu Prenume NUME**	**Semnătura**
	Course	Prof.dr. Ioan Radu Peter	
	Applications	Conf. dr. Dalia Campean	

Date of approval in the department	Head of department Prof.dr.ing. Rodica Potolea
Date of approval in the Faculty Council	Dean Prof.dr.ing. Liviu Miclea