SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Electronics, Telecommunications, and Information Technology
1.3	Department	Bases of Electronics
1.4	Field of study	Electronics and Telecommunications Engineering
1.5	Cycle of study	Master of Science
1.6	Program of study/Qualification	Integrated Circuits and Systems
1.7	Form of education	Full time
1.8	Subject code	7.00

2. Data about the subject

2.1	Subject name					Statistical modeling of signals					
2.2	Subject area					Signal processing, Statistics					
2.3	Course responsible/lecturer					Prof. Corneliu Rusu, PhD - Corneliu.Rusu@bel.utcluj.ro					
2.4	Teachers in charge of applications					Prof. Corneliu Rusu, PhD - Corneliu.Rusu@bel.utcluj.ro					
2.5	Year of study	I	2.6	Semester	2	2.7	Assessment	Exam	2.8	Subject category	DA/DI

3. Estimated total time

3.1 Hours per week	3	of which 3.2 lecture	2	3.3 tutorial / laboratory	2
3.4 Total hours in curricula	70	of which 3.5 lecture	28	3.6 tutorial / laboratory	56
Time allocation					hours
Manual, lecture material and notes, bibliography					69
Supplementary study in the library, online and in the field					30
Preparation for seminars/laboratory works, homework, reports, portfolios, essays					25
Tutoring					14
Exams and tests					3

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

4. Pre-requisites (where appropriate)

4.1 Curriculum	Signal theory, linear algebra
4.2 Competence	MATLAB programming elements

5. Requirements (where appropriate)

5.1 For lecture	Amphitheatre, Cluj-Napoca
5.2 For applications: Project	Laboratory with standard electronic equipment, Cluj-Napoca

6. Specific competences

Professional competences	After completing this course, the students should know: - Analysis and synthesis of stochastic processes - Determining a Wiener filter for a given stochastic process - Designing LMS or RLS algorithms for a given application - Identification of systems by spectral methods Identification of systems through adaptive methods
	After completing this course, the students will be able to: - Setting the parameters in the methods of spectral analysis of signals - Measurement of system parameters by spectral analysis methods - Designing structures for adaptive filters - Deconvolution of signals by cepstral methods
	By completing the discipline, the students will acquire practical skills such as: - Programming scientific and technical applications using the MATLAB program package
Transversal competences	- Know and be able to use methodologies for statistical analysis of signals

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

7.1 General objectives	The development of professional skills in the field of statistical modeling of signals and the design of adaptive filters
7.2 Specific objectives	• Assimilation of theoretical knowledge regarding the spectral analysis of stochastic signals and the use of appropriate software tools such as MATLAB for statistical modeling of signals • Obtaining the necessary skills and abilities to analyze, implement and evaluate the performances of LMS and RLS adaptive filters

8. Contents

8.1. Lecture (syllabus)	Teaching methods	Notes
Analysis of signals and systems	Presentation, heuristic conve	Use of Power Point prese ntatio
Deconvolution. Invertible systems. Cepstrum		
Equations of state		

Stochastic processes			
Spectral factorization			
Non-parametric methods in spectral estimation			
Parametric methods in spectral estimation			
Wiener filters. The principle of orthogonality			
Wiener IIR filters. Wiener FIR filters			
Gradient algorithms. The LMS algorithm			
Properties of the LMS algorithm			
Modifications and improvements of the LMS algorithm			
The RLS algorithm			
Properties of the RLS algorithm			
8.2 Laboratory		Teaching methods	Notes
1	Analysis of signals and systems	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, computers, white/magnetic board
2	Types of systems		
3	Equations of state		
4	Stochastic signals		
5	Spectral factorization of stochastic processes		
6	Vector stochastic processes		
7	Periodogram		
8	Averaging the periodogram		
9	Spectral density estimation with AR, MA and ARMA models		
10	Gradient algorithms. The LMS algorithm		
11	Algorithms derived from LMS		
12	Structures and applications of LMS adaptive filters		
13	The RLS algorithm		
14	Structures and applications of RLS adaptive filters		

Bibliography

1. C. Rusu, Filtrari adative si modelarea statistica a semnalelor, Ed. Risoprint, 2008.
2. M. Hayes, Statistical Digital Processing and Modeling, John Wiley and Sons, 1996.
3. J. G. Proakis, D.G. Manolakis. Digital Signal Processing: principles, Algorithms and Applications, 2006.
4. G. Zelniker. F. J. Taylor, Advanced Signal Processing. Marcel Dekker, 1994.
5. C. Cowan, P. Grant, Adaptive Filters, McGraw-Hill, 1983.

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 those set up by similar courses organized by top universities in Romania and abroad; also, they meet the requirements set by professional organizations and government agencies in this field, as well as the expectations of companies involved in the design, implementation and testing & characterization of integrated circuits in the automotive industry, such as the potential employers where students carry out practical placements and internships.

10. Evaluations

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Lecture	The level of acquired theoretical knowledge and skills in analysis and design of integrated circuits in automotive industry	- Summative evaluation exam (theory and problems)	- E, max 10 pts. 50%

10.5 Applications (lab)	The level of acquired practical abilities and problem-solving skills	- Individual project	- L, max. 10 pts. 50%
10.6 Minimum standard of performance			
• The final mark is calculated as follows: Mark = 0.5 E + 0.5L>4.5			

Date of filling in:	**Responsible**	**Title Surname NAME**	**Signature**
	Course and applications	Prof. Corneliu Rusu, PhD.	

Date of approval in the Department of Bases of Electronics

Head of Department

Prof. Sorin HINTEA, PhD eng

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Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology

Dean

Prof. Ovidiu Pop, PhD eng

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