COURSE GUIDE
2019-2020

Dean,
Prof. dr. ing. Daniela Tarniceriu

1.1 Higher education institution	"Gheorghe Asachi" Technical University of Iaşi
1.2 Faculty / Department	Electronics, Telecommunications and Information Technology
1.3 Department	Telecommunications and Information Technologies
1.4 Field	Electronic Engineering, Telecommunications and Information Technologies
1.5 Study level	Bachelor
1.6 Study program / Qualification	Telecommunication Technologies and Systems

2. Course info

2.1 Course name: Advanced Signal Processing Methods						CODE: EDOS 4167	
2.2 Course organizer (lecturer)		Prof. Daniela Tarniceriu					
2.3 Teaching assistants		Assoc. Prof. Nicolae Cleju					
2.4 Year of study	4	2.5 Semester	8	2.6 Assessement	Continuous Exam	2.7 Category	DOS

3. Estimated total time (hours per semester for teaching activities)

3.1 Number of hours per week	5	3.2 lecture	3	3.3 seminar/laboratory	2
3.4 Total number of hours in curricula	70	3.5 lecture	42	3.6 seminar/laboratory	28
Time distribution					hours
Textbook, course support, references and course notes study					30
Library, electronic platforms and on site documentation					12
Seminar/laboratory preparation, homework, reports, portfolios and essays					20
Tutoring					4
Assessment					4
Other activities					4

3.7 Total individual study hours	74
3.9 Total hours per semester	144
3. 10 Number of credit points	6

4. Prerequisites (where applicable)

4.1 curricula type	Digital signal Processing
4.2 competence type	

5. Infrastructure (where applicable)

• 5.1. for lectures	• Video-projector, whiteboard
• 5.2. for laboratories	• Computer network, software environments

6. Specific competences

Professional competences	• To know the terminology specific to discipline • To use properly the terminology specific to the discipline • To know the specific operations of multirate processing (decimation, interpolation), with integer and fractional factor, the temporal relation of the under-sampled or over-sampled signals with the original ones and their characterization in the frequency domain. • Implement interpolated FIR filters. • To know and use the uniform and polyphase filter banks in the multi-resolution analysis of signals. • Use Kalman filters • Design, analyze and use adaptive LMS filters • Design, analyze and use adaptive RLS filters

Transversal competences	• To use effectively the information sources and communication and professional training resources both in Romanian and in an international language • To show concern for professional development by training critical thinking skills and improving education by lifelong learning • To work in an international context.

7. Course targets (as resulting from **6. Specific competences** table)

7.1 Course main target	- In-depth knowledge of the theoretical, methodological and practical developments specific to main principles and applications of some advanced digital signal processing methods..
7.2 Course specific targets	- To demonstrate that they have acquired sufficient knowledge to understand the studied notions - To understand critically, explain and interpret theoretical, methodological and practical developments specific to the studied signal processing methods - To be able to apply properly the adequate methods and techniques in a given application

8. Contents

8. 1 Lectures	Teaching methods	Notes
Multi-resolution techniques. Basic multirate operations: decimation, interpolation, decimation with a rational factor	Combination: -the lecture method -using the video projector, explication, -debate, -case study, - connections with the content of other disciplines, with previously transmitted information within the discipline, or practical applications of the investigated problem	4 ore
Efficient structures for implementing decimation and interpolation filters		3 ore
Filter banks - uniform, polyphase, with perfect reconstruction		5 ore
Interpolated finite impulse response filters		3 ore
Kalman filtering		4 ore
Adaptive filtering – fundamentals		3 ore
Algorithms used in adaptive filtering - LMS and RLS, comparison between algorithms		6 ore
Adaptive signal processing. Adaptation algorithm with gradient decrease. The LMS algorithm. Applications		6 ore
Transformations used in signal compression		4 ore
Multi-resolution analysis of signals. Subband coding. Wavelet analysis		6 ore
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References

1. A.V. Oppenheim, R.W. Schafer, Discrete-Time Signal Processing, Prentice-Hall, 2001
2. Haykin, S., Adaptive Filter Theory, Prentice Hall, Englewood Cliffs, NJ, 1989.
3. Vaidyanathan, P. P., Filter Banks and Multirate Signal Processing, Englewood Cliffs, N. J. Prentice Hall, 1993.
4. Proakis, J. G., Rader, C. M., Ling, F., Nikias, C. L., Advanced Digital Signal Processing, Macmillan Publishing Company, 1992.
5. D. Tarniceriu, Bazele prelucrarii numerice a semnalelor, Ed. Politechnium, Iaşi, 2008, 372 pagini, ISBN 978-973-621-196-6.

8. 2 Laboratory	**Teaching methods**	**Notes**
1. Introductory MATLAB / Simulink laboratory		2 hours
2. Multi-resolution analysis. Interpolation and decimation	Solving laboratory applications in Matlab environment or C language	2 hours
3. Transformations used in signal compression		4 hours
4. Subband coding of sound and image signals		2 hours
5. Kalman filter	The exercise	2 hours
6. Design and analysis of digital filters using the least squares (LS) method	Discussions	2 hours

7. Design and analysis of adaptive digital filters LMS algorithm		2 hours
8. Design and analysis of digital adaptive filters RLS algorithm		2 hours
9. Adaptive signal processing: The LMS algorithm		2 hours
10. Applications of the LMS algorithm: system identification, prediction, noise filtering		4 hours
11. Compression techniques using wavelet analysis		4 hours

9. Course contents corroboration with the expectations of the epistemic community representatives, professional associations and relevant employers in the field of the program

In determining the content of the discipline and the methods of teaching / examination, the discipline holders consulted both Romanian and foreign academic counterparts, with whom they have links through the Erasmus / Socrates exchanges. It also takes into account the opinions and expectations of the main industrial actors in Romania, with whom we have constant collaborations. The objectives of the discipline are in perfect harmony with the curriculum, transmitting information and forming skills necessary for future specialists in the field of electronics, telecommunication and information technology. The program was designed to integrate the discipline into the curriculum for the specialization of Telecommunications Technologies and Systems, the curriculum content of the prestigious universities in the country and abroad.

10. Assessment

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Percentage of final grade
10.4 Lectures	• Knowledge acquired theoretically (quantity, accuracy)	Continuous tests: Homework: Final evaluation	0 60% (minimum mark 5)
10.5 Seminar/laboratory	• Knowing the equipment, how to use specific instruments; Evaluating tools or achievements, processing and interpreting results	• Written questionnaire • Oral response • Laboratory books (experimental papers, papers) • Practical demonstration	40% (minimum mark 5)
10.6 Minimum performance standard			
·Knowing the fundamental elements of theory (definitions, characterization in time and frequency domain of operations of decimation, interpolation, uniform filterbanks, Kalman filters, adaptive filters LMS, RMS) and solving a simple problem			

Completion date
10.09.2019

Course organizer signature,

Prof. Dr. Ing. Daniela Tărniceriu

Teaching assistant signature,

Assoc. Prof. Nicolae Cleju

Department approval date
16.09.2019

Department director signature

Conf. dr. ing. Luminița Scripcariu