COURSE GUIDE

Dean, Prof. Daniela Tărniceriu

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1. Program info

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 Technology
1.5 Study level	Bachelor's Degree Studies
1.6 Study program / Qualification	Telecommunications Systems and Technologies

2. Course info

2.1 Course name: **Decision and Estimation in Data Processing**						Code: EDID306ET	
2.2 Course organizer (lecturer)		Sef lucr. dr. ing. Nicolae Cleju					
2.3 Teaching assistants		Sef lucr. dr. ing. Nicolae Cleju					
2.4 Year of study	3	2.5 Semester	5	2.6 Assessement	E	2.7 Type of subject	DID

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

3.1 Number of hours per week	4	3.2 lecture	2	3.3 seminar/laboratory	2
3.4 Total number of hours in curricula	56	3.5 lecture	28	3.6 seminar/laboratory	28

Time distribution	hours
Textbook, course support, references and course notes study	17
Library, electronic platforms and on site documentation	-
Seminar/laboratory preparation, homework, reports, portfolios and essays	10
Tutoring	7
Assessment	6
Other activities	-

3.7 Total individual study hours	40
3.9 Total hours per semester	96
3. 10 Number of credit points	4

4. Prerequisites (where applicable)

4.1 curricula type	
4.2 competence type	Fundamentals of probability theory

5. Infrastructure (where applicable)

5.1. for lectures	Blackboard, video projector
5.2. for laboratories	Computers with simulation software Matlab R2013

6. Specific competences

esProfessional competenc	- Characterize random process using statistical and temporal expected values - Apply decision criteria for detecting the presence of a signal between two alternatives, in the case of disctete time observations - Use the minimum-risk criterion and its particular cases - Determine the estimate when using the squared-error or uniform cost functions - Evaluate the estimate quality using various criteria
Transversal competenc es	• Master the adequate mathematical formalism and the specific terminology • Use mathematical models to model simple real-life technical challenges • Evaluate advantages and disadvantages of various solutions and identify the optimal one

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

7.1 Course main target	Acquire the fundamentals for statistical analysis of random processes, evaluate and use some basic decision criteria used for signal detection, both in continuous and discrete time
7.2 Course specific targets	- Perform statistical evaluation of random signals - Know and apply decision criteria for signal detection în both continuous and discrete time observation - Use different cost functions for estimation - Evaluate the quality of the estimate

8. Contents

8. 1 Lectures	**Teaching methods**	**Notes**
Chapter I. Random signals (random variables, random processes, common distributions, statistical and temporal averages, the autocorrelation function, the Wiener-Khincin theorem, properties of the autocorrelation function)	Exposition and slides Explanations and discussion Case studies Connections with related disciplines	4 lectures
Chapter II. Signal detection theory (Decision criteria: maximum likelihood, minimum probability of error, minimum risk, Neyman-Pearson; Receiver Operating Characteristic, matched filters; the k-NN algorithm, the k-Means algorithm)		6 lectures
III. Parameter estimation (estimators: maximum likelihood, maximum a posteriori minimum mean squared errors, cost functions; evaluating estimate quality)		4 lectures

References:

1. Brown, R. G., Hwang, P. Y. C., *Intoduction to random signals and applied Kalman filtering*, John Wiley and Sons, Inc., Second Edition, 1992.
2. Garcia, A. L., *Probability and random processes for electrical engineering*, Addison-Wesley Publishing Company, 1989
3. Munteanu V. *Detectie si estimare*, Editura "Gh. Asachi" Iasi, 1997.
4. Borda M. E. *Teoria transmisiunii informatiei*, Partea I-a, *Teoria informatiei si codarii* (fundamente si aplicatii), Universitatea Tehnica Cluj - Napoca, 1993.
5. Munteanu, V., *Teoria transmiterii informatiei*, Editura "Gh. Asachi" Iasi, 2001.

8. 2a Seminar	**Teaching methods**	**Notes**
Random variables and probability densities	Exercises Case studies	
Random processes and statistical means		
Maximum Likelihood decision criterion		
Other decision criteria		
Signal detection with multiple samples		
Maximum Likelihood estimation		
Maximum A Posteriori estimation		
References: Moodle webpage		
8. 2b Laboratory	**Teaching methods**	**Notes**
Introductory laboratory. Random variables and probability distributions.	Solving laboratory application in Matlab Exercises Discussions Case studies	
Receiver Operating Characteristic for thresholding-based decision		
Signal detection for Binary Phase-Shift Keying (BPSK) modulation		
Signal classification with the k-NN algorithm		
Signal clustering with the k-Means algorithm		
Parameter estimation		
Recovery of missed laboratories / Practical test		
References: Moodle webpage		

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

The objectives of the discipline are în concordance with the education plan, providing key techniques for future electronic and telecommunication engineers. The contents of the discipline are în concordance with the curricula of prestigious universities in the world as well as with the leading industry companies în Romania.

10. Assessment

Activity type	**10.1 Assessment criteria**	**10.2 Assessment methods**	**10.3 Percentage of final grade**

10.4 Lectures	Correctness and accuracy of responses to exercises and theoretical questions	Final evaluation: written exam, with theoretical questions and practical exercises in equal amount	60%
10.5Applications	Seminar: Frequency, relevance and correctness of answers to exercises	• Activity throughout semester • Three short tests in weeks 5, 9, 13 based on exercises from previous seminars •	40%
	Lab activity during all the semester (accuracy of the implementation, interpretation of the simulation results, answers) Final laboratory test: Correctness of implementation of a practical exercise	• Activity throughout semester • Final test: Matlab implementation of an exercise	
10.6 Minimum performance standard			
Knowledge of basic theoretical concepts, solving a basic exercise			

Completion date:
11.09.2019

Course organizer signature,
S.l.dr. ing. Nicolae Cleju

Teaching assistant signature,
S.l. dr.ing. Nicolae Cleju

Department approval date,

16. SEP. 2019

Department director signature,
Conf.dr.ing. Luminița Scripcariu