SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Electronics, Telecommunications and information Technology
1.3 Department	Communications
1.4 Field of study	Electronic Engineering, Telecommunications and Information Technologies
1.5 Cycle of study	Bachelor of Science
1.6 Program of study / Qualification	Telecommunications Technologies and Systems / Engineer
1.7 Form of education	Full time
1.8 Subject code	TST-E38.00

2. Data about the subject

2.1 Subject name	Decision and estimation in information processing						
2.2 Subject area	Theoretical area Methodological area Analytic area						
2.3 Course responsible	Professor Monica BORDA, PhD, monica.borda@com.utcluj.ro						
2.4 Teacher in charge with seminar / laboratory / project	Professor Monica BORDA, PhD Assoc. Prof. Raul MALUTAN, PhD raul.malutan@com.utcluj.ro Assistant Andreia MICLEA, Andreia.Miclea@com.utcluj.ro						
2.5 Year of study	III	2.6 Semester	6	2.7 Assessment	Exam	2.8 Subject category	DD/DI

3. Estimated total time

3.1 Number of hours per week	4	of which: 3.2 course	2	3.3 seminar / laboratory	2
3.4 To Total hours in the curriculum	56	of which: 3.5 course	28	3.6 seminar / laboratory	28

Distribution of time	hours
Manual, lecture material and notes, bibliography	10
Supplementary study in the library, online specialized platforms and in the field	-
Preparation for seminars / laboratories, homework, reports, portfolios and essays	4
Tutoring	2
Exams and tests	3
Other activities	-

3.7 Total hours of individual study	19
3.8 Total hours per semester	75
3.9 Number of credit points	3

4. Pre-requisites (where appropriate)

4.1 curriculum	*NA*
4.2 competence	NA

5. Requirements (where appropriate)

5.1. for the course	
5.2. for the seminars / laboratories / projects	Mandatory presence

6. Specific competences

Professional competences	**C4. Design, implementation and operation of data, voice, video and multimedia services. This is based on the understanding and the application of fundamental concepts in telecommunications and transmission of information** C4.1 Identification of the fundamental concepts regarding the transmission of information and analog and digital communications C4.2 Solving practical problems using general knowledge of multimedia techniques C4.3 Explanation and interpretation of the main requirements and specific approach techniques for data, voice, video, multimedia transmissions C4.3 Solving practical problems using general knowledge of multimedia techniques C4.4 Use of the main specific parameters in evaluations based on the concept of quality of service in communications C4.5 Development of simple communications services
Cross competences	N / A

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

7.1 General objective	Development of professional abilities in the domain of binary decision and signal and parameter estimation systems.
7.2 Specific objectives	1. Gain of theoretical knowledge concerning the design of decision and estimation systems. 2. Gain of theoretical knowledge concerning design of random processes, Markov processes and of the noise in digital communication systems. 3. Achievement of abilities and skills necessary for the implementation of software applications or hardware schemes using MATLAB and LABVIEW tools

8. Contents

8.1 Lecture (syllabus)		Teaching methods	Notes
1	Random variables.	Presentation, heuristic conversation exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of blackboard
2	Random processes. Stationarity and ergodicity		
3	Noise sequences and pseudo-noise sequences.		
4	Markov processes.		
5	Noise: definition, classification, models.		
6	Noise in telecommunications systems.		
7	Theory of decision. Decisions criteria (Bayes, Kotelinkov-Zeigert, Fischer, Min-max, Neyman-Pearson)		
8	Binary decision with discrete observation.		
9	Binary decision with continuous observation		
10	Theory of parameter estimation		
11	Model of an ITS with parameter estimation.		

	Discrete and continuous observation. Costs function.		
12	Minimum mean square error estimation. MAP estimation		
13	Continuous observation random signal estimation		
14	Review of the course concerning the exam.		
8.2. Applications (lab)		Teaching methods	Notes
1	Introduction. Random variables	Didactic and experimental proof, didactic exercise, team work	Use of computers, magnetic board
2	Experimental determination of the probability distribution function		
3	Pseudo-noise sequences		
4	Markov processes. Noise in telecommunications systems		
5	Binary decision system		
6	Parameter estimation system		
7	Review seminary		

Bibliography

1. M. Borda, Fundamentals in Information Theory and Coding – Springer 2011, ISBN 978-3-642-20346-6, 509p
2. S. M. Kay – Fundamentals of statistical signal processing, Vol. 1: Estimation Theory, Prentice Hall 1993
3. S. M. Kay – Fundamentals of statistical signal processing, Vol. 2: Detection Theory, Prentice Hall 1998
4. Monica Borda – Information Theory and Coding, Editura UT PRES, 2007
5. M. Borda, M.Cislariu, I.Ilea, R.Malutan, R.Terebes, Decizie și estimare în prelucrarea informației, Aplicații, Editura UTPRES, ISBN 978-606-737-252-6 , Cluj-Napoca, 2017, 256p
6. M. Simon, S, Hinedi, W, Lindsey – Digital Communications Techniques. Signal Design and Detection,
7. Prentice Hall, 1994
8. M. Barkat – Signal Detection and Estimation, Artech House,1991
9. I.Sztojanov, I. Gavăt, I. Spânu, M. Bâtiu - Teoria Transmiterii Informaţiei- îndrumător de laborator, Litografia IPCN 1983, tradus in limba engleză, format pdf

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 (in the field of electronic engineers, telecommunications engineers, electro-technology engineers, ICT specialists), and the expectations of the national organization for quality assurance (ARACIS).

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The level of acquired theoretical knowledge and practical skills	Written exam composed of 4-5 theoretical subjects and 3-4 problems	*75%*
10.5 Seminar/ Laboratory	The level of acquired knowledge and abilities	Continuous formative evaluation consisting of 4 written lab tests	*25%*
10.6 Minimum standard of performance			

Qualitative point of view

Minimal theoretical and practical knowledge:

- ✓ Understanding the information concerning the design of decision and estimation systems.
- ✓ Understanding the concepts concerning the design of random processes, Markov processes and of the noise in digital communication systems

Minimal acquired competences:

- ✓ Ability to solve problems related to binary decision and signal and parameter estimation systems
- ✓ Ability to design decision and estimation systems

Quantitative point of view

- ✓ Correct answer of at least 3 theoretical subjects and 2 problems
- ✓ Minimal mean at the exam 5
- ✓ Final mark = 0.75xExam+ 0.25x Mean of the marks at the lab tests

Date of filling in:	**Responsible**	**Title First name SURNAME**	**Signature**
28.09.2020	Course	Professor Monica BORDA, PhD	
	Applications	Assoc. Prof. Raul MALUTAN, PhD	
		Assistant Andreia MICLEA, PhD student	

Date of approval in the Department of Communications 28.09.2020	Head of Communications Department Prof. Virgil DOBROTA, Ph.D.
Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology 29.09.2020	Dean Prof. Gabriel OLTEAN, Ph.D.