

## 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	Applied Elects / 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, Ph.D.						
2.4 Teacher in charge with seminar / laboratory / project	Professor Monica BORDA, Ph.D. <a href="mailto:monica.borda@com.utcluj.ro">monica.borda@com.utcluj.ro</a> Assoc. Prof. Raul MALUTAN, Ph.D. <a href="mailto:raul.malutan@com.utcluj.ro">raul.malutan@com.utcluj.ro</a> Assist. Stefania BARBURICEANU, Ph.D. <a href="mailto:Stefania.Barburiceanu@com.utcluj.ro">Stefania.Barburiceanu@com.utcluj.ro</a>						
2.5 Year of study	III	2.6 Semester	6	2.7 Assessment	Exam	2.8 Subject category	DID/DOB

### 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					56
Supplementary study in the library, online specialized platforms and in the field					8
Preparation for seminars / laboratories, homework, reports, portfolios and essays					4
Tutoring					2
Exams and tests					3
Other activities					1
3.7 Total hours of individual study	74				
3.8 Total hours per semester	130				
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	<p>(corelat cu Grila 2)</p> <p><b>C4. Conceperea, implementarea și operarea serviciilor de date, voce, video, multimedia, bazate pe înțelegerea și aplicarea noțiunilor fundamentale din domeniul comunicațiilor și transmisiunii informației</b></p> <p>C4.1 Identificarea conceptelor fundamentale referitoare la transmisiunea informației și la comunicațiile analogice și digitale</p> <p>C4.2 Explicarea și interpretarea principalelor cerințe și tehnici specifice de abordare pentru transmisiile de date, voce, video, multimedia</p> <p>C4.3 Rezolvarea de probleme practice utilizând cunoștințe generale privind tehnicile multimedia</p> <p>C4.4 Utilizarea principalilor parametri specifici în evaluări bazate pe conceptul de calitate a serviciilor în comunicații</p> <p>C4.5 Dezvoltarea unor servicii simple de comunicații</p>
Cross competences	<p>(corelat cu Grila 2)</p> <p>N / A</p>

### 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	<ol style="list-style-type: none"> <li>1. Gain of theoretical knowledge concerning the design of decision and estimation systems.</li> <li>2. Gain of theoretical knowledge concerning design of random processes, Markov processes and of the noise in digital communication systems.</li> <li>3. Achievement of abilities and skills necessary for the implementation of software applications or hardware schemes using MATLAB and LABVIEW tools</li> </ol>

### 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		
<b>Bibliography</b>			
<ol style="list-style-type: none"> <li>1. M. Borda, Fundamentals in Information Theory and Coding – Springer 2011, ISBN 978-3-642-20346-6, 509p</li> <li>2. S. M. Kay – Fundamentals of statistical signal processing, Vol. 1: Estimation Theory, Prentice Hall 1993</li> <li>3. S. M. Kay – Fundamentals of statistical signal processing, Vol. 2: Detection Theory, Prentice Hall 1998</li> <li>4. Monica Borda – Information Theory and Coding, Editura UT PRES, 2007</li> <li>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</li> <li>6. M. Simon, S. Hinedi, W, Lindsey – Digital Communications Techniques. Signal Design and Detection, Prentice Hall, 1994</li> <li>7. M. Barkat – Signal Detection and Estimation, Artech House, 1991</li> <li>9. I.Sztojanov, I. Gavăt, I. Spănu, M. Bătiu - Teoria Transmiterii Informației- îndrumător de laborator, Litografia IPCN 1983, tradus in limba engleză, format pdf</li> </ol>			

**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%
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10.6 Minimum standard of performance
<p><b>Qualitative point of view</b></p> <p>Minimal theoretical and practical knowledge:</p> <ul style="list-style-type: none"> <li>✓ Understanding the information concerning the design of decision and estimation systems.</li> <li>✓ Understanding the concepts concerning the design of random processes, Markov processes and of the noise in digital communication systems</li> </ul> <p>Minimal acquired competences:</p> <ul style="list-style-type: none"> <li>✓ Ability to solve problems related to binary decision and signal and parameter estimation systems</li> <li>✓ Ability to design decision and estimation systems</li> </ul> <p><b>Quantitative point of view</b></p> <ul style="list-style-type: none"> <li>✓ Correct answer of at least 3 theoretical subjects and 2 problems</li> <li>✓ Minimal mean at the exam 5</li> <li>✓ Final mark = 0.75xExam+ 0.25x Mean of the marks at the lab tests</li> </ul>

Date of filling in:	Responsible	Title Surname NAME	Signature
13.09.2022	Course	Professor Monica BORDA, Ph.D.	
	Applications	Assoc. Prof. Raul MALUTAN, Ph.D.	
		Assist. Stefania BARBURICEANU, Ph.D.	

Date of approval in the Council of the Communications Department 13.09.2022	Head of Communications Department Prof. Virgil DOBROTA, Ph.D.
Date of approval in the Council of the Faculty of Electronics, Telecommunications and Information Technology 21.09.2022	Dean Prof. Ovidiu POP, Ph.D.