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: **Information Theory**						Code: EDID208	
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	2	2.5 Semester	4	2.6 Assessement	E	2.7 Type of subject	DID

208

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	20
Library, electronic platforms and on site documentation	7
Seminar/laboratory preparation, homework, reports, portfolios and essays	14
Tutoring	7
Assessment	2
Other activities	0

3.7 Total individual study hours	50
3.9 Total hours per semester	120
3. 10 Number of credit points	5

4. Prerequisites (where applicable)

4.1 curricula type	
4.2 competence type	Basic knowledge of probabilities and statistics

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	• Explain the main information-theoretic concepts and quantities • Use the mathematical models of and an information source with or without memory, and compute the expected information • Identify the basic types of informational channels and compute their main characteristics • Use the Shannon-Fano and Huffman coding techniques and evaluate their advantages and disadvantages • Apply Hamming and convolutional error correcting codes for data protection
Transversal competencies	• 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	Students should acquire knowledge and use the central elements of information and coding theory (discrete information sources, discrete transmission channels, information quantities, entropy coding, error correcting codes).
7.2 Course specific targets	- To present the fundamental quantities in information theory; - To introduce basic discrete information source and discrete channel models; - To develop source coding techniques for noiseless channels; - To know unique decipherable codes of variable length; - To present basics of source coding for noisy channels.

8. Contents

8. 1 Lectures	**Teaching methods**	**Notes**
Discrete sources of information 1.Discrete memoryless information source and its extensions 2.Entropy and its properties 3.Markov discrete sources 4.Entropy of ergodic Markov sources	Exposition, slides on video projector, some explanations at blackboard, discussion with students	2 lecture
Information channels 1.Definition and classification 2.Entropy of the input-output joint field 3.Conditional entropies 4.Relationships between entropies 5.Mutual information 6.Definition of capacity, redundancy and efficiency of discrete channels 7.Capacity of some basic discrete channel types		3 lectures
Source coding 1.Definitions 2.The coding theorem for existence of instantaneous codes 3.Average length of codewords 4.Code capacity, redundancy and efficiency 5.The theorem of source coding for noiseless channels 6.Shannon - Fano binary algorithm coding 7.Huffman coding, binary and multi-ary		3 lectures
Error correction codes 1. Linear block codes 2. Hamming codes		6 lectures

3. Cyclic codes, encoder and decoder		
References: • V. Munteanu, D. Tărniceriu, *Elements of Information Theory*, Ed. CERMI, 2007 • *Information and Coding Theory*, Gareth A. Jones and J.Mary Jones, Springer, 2000. • *Elements of Information Theory*, 2nd ed., Thomas M.Cover, Joy A. Thomas, Wiley, 2006, • Gallager R., *Information Theory and Reliable Communication*,. John Wiley and Sons, 1968		
8. 2 Laboratory	**Teaching methods**	**Notes**
1. Safety regulation and introduction	Solving laboratory application in Matlab / C language Exercises Discussions Case studies	2h
2. Entropy of a discrete memoryless source		2h
3. Random data generator		2h
4. Source coding: encoding		2h
5. Source coding: decoding		2h
6. Source coding: Shannon coding		2h
7. Data protection with parity bit: encoding		2h
8. Data protection with parity bit: decoding		2h
9. Hamming coding		2h
10. Hamming decoding		2h
11. CRC16 coding and decoding		2h
12. Binary Symmetric Channel		2h
13. Recovery of missed laboratories		2h
14. Final test		2h
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

This course introduces the basic notions of information that are useful in most domains of IT engineering. In particular, knowledge of source coding, compression, channel capacity and error corrections schemes are fundamental in the fields of digital communication and data science.

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	60%
10.5 Applications	Lab activity during all the semester (accuracy of the implementation, interpretation of the simulation results, answers)	Oral answers, practical demonstration	40%

	Correctness and accuracy of responses to exercises and theoretical questions	Intermediary tests[i]: 3 tests, weeks 5 / 8 / 11
	Final test: Correctness of the implementation of an exercise	Laboratory test: Implementation of an exercise
10.6 Minimum performance standard		
•Knowledge of basic concepts (for example entropy, average codeword length), solving a simple coding/decoding application		

Completion date: 11.09.2019

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

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

Department approval date, 16. SEP. 2019

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

i *Se va preciza numărul de teste și săptămânile în care vor fi susținute.*