SYLLABUS

1. Program information

1.1 Higher education 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 Study program / Qualification	Telecommunications Technologies and Systems/ Engineer
1.7 Form of education	IF – full-time education

2. Course information

2.1 Course title	Theory of Information Transmission				Course code		TST-E33.00
2.2 Course coordinator	*Professor Monica BORDA, Ph.D. - Monica.Borda@com.utcluj.ro*						
2.3 Seminar/ laboratory/ project/ practical activity coordinator	*Assoc. Prof. Raul MALUTAN, Ph.D.- Raul.Malutan@com.utcluj.ro* *Assist. Prof. Stefania BENEA, Ph.D. -Stefania.Benea@com.utcluj.ro*						
2.4 Year of study	3	2.5 Semester	5	2.6 Type of assessment			E
2.7 Course status	Formative category						DF
	Optionality						DOB

3. Estimated total time

3.1 Hours per week	5	of which:	3.2 Lecture	2	3.3 Seminar	1	3.3 Laboratory	2	3.3 Project	-	3.3 Practical training	-
3.4 Hours per semester	70	of which:	3.5 Lecture	28	3.6 Seminar	14	3.6 Laboratory	28	3.6 Project	-	3.3 Practical training	-

3.7 Time distribution (hours per semester) for individual study and assessment:	
(a) Assessment	5
(b) Study using textbook, course materials, bibliography, and notes	14
(c) Additional documentation in the library, on specialized electronic platforms, and in the field	14
(d) Preparation for seminars/laboratories, assignments, reports, portfolios and essays	14
(e) Tutoring	8
(f) Other activities	-
3.8 Total hours of individual study and assessment (sum of (3.7(a)...3.7(f))	55
3.9 Total hours per semester (3.4+3.8)	125
3.10 Number of credits	5

4. Prerequisites (where applicable)

4.1 curriculum	N/A
4.2 competencies	N/A

5. Requirements (where applicable)

5.1. for the development of the lecture	Cluj-Napoca
5.2. for the development of the seminar/ laboratory/ project	Cluj-Napoca

6. Specific competencies acquired

Professional competencies	C2. Applying the basic methods for the acquisition and processing of signals C3. Application of the basic knowledge, concepts and methods regarding the architecture of computer systems, microprocessors, microcontrollers, languages and programming techniques
Transversal competencie	N/A

7. Expected learning outcomes

Knowledge	**K2.** The student/ graduate explains and interprets theoretical and experimental results from mathematics, physics, chemistry, economics, technical drawing and computer science. **K4.** The student/ graduate describes, identifies, summarizes concepts and elementary methods of signal acquisition, analysis and processing, implemented in systems with general-purpose processors or signal processors and their application in concrete problems
Skills	**S5.** The student/graduate applies evaluation criteria and methods to identify, model, experiment with, analyze, and qualitatively and quantitatively assess phenomena and processes specific to the fundamental field, including using digital technologies. **S6**. The student/ graduate designs solutions—in compliance with relevant standards—for engineering problems of moderate complexity that meet specified needs, while adhering to requirements regarding public health, safety, well-being, the environment, sustainability, and economic factors, as well as other specific constraints. **S13.** The student/graduate uses specific methods and tools for the characterization of signals in the time domain and in the frequency domain, performs the acquisition, analysis and digital processing of analog signals. **S14.** The student/ graduate designs, measures, evaluates the performance, diagnoses and troubleshoots functional blocks of low/medium complexity for digital signal analysis and processing, using dedicated simulation environments (Matlab, Python, etc.). **S15.** Develop and plan ICT networks, such as a wide area network and a local area network, that connect equipment via wired or wireless connections and allow them to exchange data and assess their capacity requirements.

Responsibility and autonomy	**R7.** The student/ graduate is fluent in at least one international language in technical communication **R9.** The student/ graduate demonstrates initiative and takes action to update their professional, economic, and organizational culture knowledge.

8. Course objectives (based on the grid of specific competencies acquired)

8.1 General objective of the course	Development of professional abilities in the domain of information transmission, of source coding and channel coding.
8.2 Specific objectives	1. Gain of theoretical knowledge concerning the statistical and informational modeling of digital transmission systems. 2. Gain of theoretical knowledge concerning source coding for information representation and compression. 3. Gain of theoretical knowledge concerning channel coding for error control 4. Achievement of abilities and skills necessary for software and hardware implementation using MATLAB and LABVIEW tools

9. Contents

9.1 Lecture	**No. of hours**	**Teaching methods**	**Remarks**
1. Introduction. Information Transmission Systems (ITS).	2	Presentation, heuristic conversation exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of greenboard
2. Memory-less information sources. Quantitative measures for numerical information. Informational Entropy.	2		
3. Moments and moments rate. Information rate, decision rate. Discrete transmission channels. Probabilities and entropies in channels. Mutual information and trans-information. Relationships between entropies. Types of channels.	2		
4. Capacity of a channel given by bandwidth and SNR (Shannon's capacity formula). Shannon's limit. Capacity of a BSC	2		
5. Source coding: definition, aim, lossless compression. Codes for information representation. Compression efficiency. Compression ratio. Existence theorem of instantaneous codes, uniquely decodable codes. Shannon's first theorem (Lossless compression theorem)	2		
6. Compression algorithms: Shannon-Fano, Huffman. Conclusions concerning compression. Channel coding. Shannon's second theorem (noisy channel coding theorem). Error control strategies. Classification of error control codes.	2		
7. Block codes: algebraic theory, definition, representation, error control matrix, generator matrix. Perfect and almost	2		

9.1 Lecture	No. of hours	Teaching methods	Remarks
perfect codes. Error syndrome. Relationships between the columns of H matrix for error detection/correction. Hamming group codes.			
8. Other block codes. Cyclic codes: definition and representation, algebraic coding. Elements of Galois fields for cyclic coding.	2		
9. BCH codes. Error syndrome and error detection. Algebraic decoding (Peterson algorithm)	2		
10. Reed-Solomon Codes. Coding and algebraically decoding	2		
11. Circuits for cyclic coding and decoding. LFSR for cyclic codes implementation. Cyclic code using LFSR for error detection and correction	2		
12. Convolutional codes: definition and representation. Comparison with block codes, algebraic coding, implementation with feed-forward SR	2		
13. Trellis representation. Code distance. Viterbi decoding	2		
14. Interleaving and concatenation: principles and applications. Review of the course concerning the exam.	2		
9.2 Laboratory	**No. of hours**	**Teaching methods**	**Remarks**
1. Introduction and presentation of laboratory requirements.	4	Didactic and experimental proof, didactic exercise, teamwork	Use of computers, magnetic board
2. Information representation codes	4		
3. Source coding	4		
4. Hamming group codes	4		
5. BCH and Reed-Solomon Codes	4		
6. LFSR. Application for cyclic coding	4		
7. Convolutional codes	4		
9.3 Seminar	**No. of hours**	**Teaching methods**	**Remarks**
1. Statistical modeling of an ITS	2	Didactic and experimental proof, didactic exercise, teamwork	Use of computers, magnetic board
2. Informational modeling of an ITS	2		
3. Compression algorithms	2		
4. Linear group codes	2		
5. BCH and RS codes	2		
6. LFSR for cyclic codes implementation	2		
7. Convolutional codes	2		

References:

1. M. Borda, *Fundamentals in Information Theory and Coding,* Springer 2011, ISBN 978-3-642-20346-6, 509p.
2. M. Borda, *Information Theory and Coding*, UTPRES Cluj-Napoca, 2007
3. G. Wade, *Signal coding and processing*, Palgrave-McMillan, 2000
4. R. Gallagher, *Information theory and reliable communication*, John Wiley & Sons, 1968

9.1 Lecture	No. of hours	Teaching methods	Remarks
5. B. Sklar, *Digital Communications*, Prentice Hall, 2001 6. D. Salomon, *A guide to data compression methods*, Springer-Verlag, 2002 7. M. Borda, R. Terebes, C. Vaduva, S. Zahan, *Teoria transmiterii informatiei*, UTCN, 1997 – translated in English (.pdf format) 8. I.Sztojanov, I. Gavăt, I. Spânu, M. Bâtiu, *Teoria transmiterii informatiei- îndrumător de laborator*, Litografia IPCN 1983, translated in English (.pdf format)			

10. Alignment of the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The discipline content and the acquired skills are in agreement with the expectations of the professional Competences acquired will be used in the following COR occupations (Electronics Engineer; Telecommunications Engineer; Electronics Design Engineer; System and Computer Design Engineer; Communications Design Engineer) or in the new occupations proposed to be included in COR (Sale Support Engineer; Multimedia Applications Developer; Network Engineer; Communications Systems Test Engineer; Project Manager; Traffic Engineer; Communications Systems Consultant).

11. Assessment

Activity type	11.1 Assessment criteria	11.2 Assessment methods and type of assessment: continuous/ summative)	11.3 Weight in final grade
11.4 Course	The level of acquired theoretical knowledge and practical skills	Written exam composed of 4-5 theoretical subjects and 3-4 problems	75%
11.5 Seminar/ Laboratory	The level of acquired knowledge and abilities	Continuous formative evaluation consisting of 6 written lab tests	25%

11.6 Minimum performance standard

Qualitative point of view

Minimal theoretical and practical knowledge:

- ✓ Understanding the statistical and informational modeling of digital transmission systems.
- ✓ Understanding the concepts of source coding for information representation and compression
- ✓ Understanding the concepts of channel coding for error control

Minimal acquired competences:

- ✓ Ability to solve problems related to information theory
- ✓ Ability to design codes for error control

Quantitative point of view

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

Completion date:	**Course coordinators**	**teaching rank, title First name LAST NAME**	**Signature**
16.06.2026	Course	*Professor Monica BORDA, Ph.D. - Monica.Borda@com.utcluj.ro*	
	Applications	*Assoc. Prof. Raul MALUTAN, Ph.D.- Raul.Malutan@com.utcluj.ro*	
		Assist. Prof. Stefania BENEA, Ph.D. - Stefania.Benea@com.utcluj.ro	

Approval of the Head of the Department coordinating the course, only if this differs from the department organizing the study program	Head of Department

Date of approval by the Council of the Communications Department 19.06.2026	Head of Communications Department Prof. Virgil DOBROTA, Ph.D.
Date of approval by the Council of the Faculty of Electronics, Telecommunications and Information Technology 30.06.2026	Dean, Prof. Ovidiu-Aurel POP, Ph.D.