SYLLABUS

Discipline name	Information Theory and Coding
Profile	Electronics and Telecommunications Engineering
Specialization	Telecommunications Technologies and Systems
Code	51323509
Course leader	Professor Monica BORDA, Ph.D – Monica.Borda@com.utcluj.ro
Collaborators	Assistant Professor Sorin POP, Ph.D, Sorin.Pop@com.utcluj.ro, Assistant Raul MALUTAN - Raul.Malutan@com.utcluj.ro
Department	Communications
Faculty	Electronics, Telecommunications and Information Technology

Sem.	Type of discipline	Course	Applications			Course	Applications			Ind. study	TOTAL	Credits	Form of assessment
		[hours/week]				[hours/semester]							
			S	L	P		S	L	P				
5	**Engineering**	**2**	**1**	**2**	**-**	**28**	**14**	**28**	**-**	**80**	**150**	**5**	**Exam**

Acquired competences :

Acquired skills (what the student is able to do):

- Ability to model an information transmission system (statistically and informationally)
- Ability to compare different compression algorithms
- Ability to compare different channel coding techniques
- Understanding of the main lossless and lossy source coding algorithms
- Understanding of the main error control strategies and algorithms

Acquired abilities (what type of equipment/ instruments/ software the student is able to handle):

- Capability to design and implement source and channel coding algorithms

Prerequisites (if necessary):

Basics of probability theory, algebra fundamentals, digital circuits, analogical circuits.

A. Course/Lecture (course/lecture titles)	
1	Information transmission systems (ITS)
2	Statistical and Informational Model of an ITS (Discrete Memoryless Information Sources DMS, Measure of Discrete Information, Informational Entropy for a DMS, Source redundancy and Efficiency, The Entropy of an Extended DMS, Moments and Moment rate, Information rate. Decision rate
3	Statistical and Informational Model of an ITS (Discreet transmission channels: statistical and informational model, Channel Capacity)
4	Source Coding (C_s): aim, codes for information representation, compression ratio, coding efficiency, Kraft's and Mc Millan inequalities, Shannon's First Theorem
5	Shannon-Fano and Huffman Algorithms
6	Shannon's second theorem, Error control strategies, Parameters of error control codes
7	Linear block codes: definition and matrix description
8	Error syndrome, Detection and correction capability, Relations between the columns of Hmatrix for error detection
9	Hamming codes
10	Cyclic codes (BCH): Definition and representation, Algebraic encoding
11	Algebraic decoding (Peterson algorithm)
12	Non binary cyclic codes (Reed-Solomon)
13	Hardware implementations for cyclic codes
14	Convolution codes

B. Applications – **Laboratory** (list of 4 hours laboratories)	
1	Introduction. Information representation codes.
2	Source coding (compression algorithm)
3	Hamming codes
4	BCH codes
5	Reed Solomon codes
6	Hardware implementation of cyclic codes
7	Convolution codes

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Seminar (contents) – 2 hours	
1	Statistical model of an ITS
2	Informational model of an ITS
3	Compression
4	Group Codes – Hamming codes
5	BCH codes
6	Reed Solomon Codes
7	Convolution codes

C. Individual study (reference study contents, synthesis materials, projects, applications etc.)

2 synthesis reports
12 sets of problems (the preparation part in every laboratory)
3 sets of problems (course homework)

Individual study structure	Course study	Problem solving, laboratory, project	Applications preparation	Examination time	Additional reference study	Total no. of individual study hours
Hours	28	31	18	3	-	80

References (Textbooks, courses, laboratory manual, exercise book)

1. Monica Borda – *Information Theory and coding.* UT Press, 2007
2. R. Gallagher - *Information theory and reliable communication*, John Willey and sons (1968).
3. R. Hamming, *Coding and Information Theory*, Prentice Hall, 1980.
4. G. Wade – *Signal coding and processing,* Palgrave-McMillan, 2000.
5. B. Sklar, *Digital Communications*, Prentice Hall, 2001 (second edition)
6. Monica Borda –*Teoria Transmiterii Informației,* Editura Dacia, 1999.

Final evaluation	
Evaluation method	Written exam (E): problem solving (70%) and theoretical subjects (30%).
Mark components	Exam (E: 0…10 points); Laboratory (L: 0…10 points); Homework (H: 0…10 points);
Mark computation	$M = 0.6E + 0.2L + 0.2H$. Pass if: $E \geq 4$ and $L \geq 4$ and $M \geq 4.5$

Course leader,

Professor Monica BORDA Ph.D.

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