SYLLABUS

Discipline name	Discrete Mathematics
Profile	Electronics and Telecommunications Engineering
Specialization	Telecommunications Technologies and Systems (English)
Code	51322309
Course leader	Assistant Professor Bogdan-Ionut Gavrea, Ph.D. Bogdan.Gavrea@math.utcluj.ro
Collaborators	
Department	Mathematics
Faculty	Automation and Computer Science

Sem.	Type of Discipline	Course	Applications			Course	Applications			Ind. study	TOTAL	Credits	Form of assessment
		[hours/week]				[hours/week]							
			S	L	P		S	L	P				
3	**Fundamental**	**2**	**1**	**-**	**-**	**28**	**14**	**-**	**-**	**78**	**120**	**4**	**Exam**

Acquired competences :
Acquired skills (what the student is able to do):
Mathematical models of discrete and continuous signals; the Z-transform and its inverse; the discrete and continuous Fourier transform; the Fast Fourier Transform; the Laplace transform; basic probability theory: mathematical definition of the probability concept, conditional probability, Bayes formula, the total probability formula, random variables/vectors (continuous and discrete), functions of random variables, numerical characteristics of random variables; brief overview of stochastic processes and Markov chains; introductory notions on interpolation theory.
Acquired abilities: (what type of equipment/instruments/software the student is able to handle)
After taking this class the students should: – Be able to work with the studied discrete and continuous transforms – Be able to operate with probability rules – Be able to work with random variables – Be able to use basic polynomial interpolation theory.

Prerequisites (if necessary)
Mathematical Analysis 1st and 2nd semester

A. Course/Lecture (course/lecture titles)	
1	Mathematical representation of discrete and continuous signals. Approximating continuous signals by discrete signals. Convolution product of discrete signals. l_1 and l_2 signals. Discrete linear systems: causal and non-causal systems, time-invariant systems.
2	The Z-Transform. Basic properties of the unilateral Z-transform.
3	The inverse Z-transform. Digital filters and the Z-transform. Definition of the Discrete Fourier Transforms (DFT). Examples of applications of the DFT in signal processing.
4	Properties of the DFT. Parceval's identities. The Fast Fourier Transform (FFT) and its computational advantages.
5	The Laplace transform. Definition and properties of the transform.
6	The Fourier transform on $L_1(\Re)$ and $L_2(\Re)$. The Cosine and Sine transforms.
7	Basic probability theory. Field of events, probability space, probability measure. Basic probability properties. Geometric interpretation of the probability measure.
8	Conditional probability. Application: reliability of technical devices. Sequences of independent trials: Bernoulli scheme, Poisson scheme.
9	The total probability formula and Bayes formula.
10	Random variables. Important discrete and continuous variables.
11	Numerical characteristics of random variables. Functions of random variables. Random vectors.
12	A brief introduction to stochastic processes and Markov chains.
13	Elements of interpolation theory: Lagrange interpolation.
14	Elements of interpolation theory: Spline interpolation.

B1. **Applications** – **Laboratory** (list of laboratories), **Seminar** (contents), **Project** (project contents)	
1	Discrete and continuous signals. l_1 and l_2 signals. Discrete linear systems.
2	The Z-Transform. The inverse Z-transform. Digital filters and the Z-transform.
3	The DFT and FFT. The Laplace transform.
4	The Fourier transform on $L_1(\Re)$ and $L_2(\Re)$.
5	Basic probability theory. Conditional probability. Bayes' formula and the total probability formula.
6	Random variables, random vectors and Markov chains.
7	Elements of interpolation theory: Lagrange interpolation and spline interpolation.

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

- Seven sets of problems.
- Preparing a synthesis paper.

Individual study structure	Lecture notes study	Homework solving, labs, projects	Applications preparation	Assessment time	Supplementary bibliographical research	Total hours individual study
Nr. ore	28	36	-	6	8	78

D. Strategies and teaching methods

- conventional blackboard lectures.
- computer presentations (using video projectors) of applications and certain applied examples.
- office hours.

References (Cursuri, indrumatoare de lucrari, proiect, culegeri de probleme)

1. Gavrea, B., - Lecture Notes. Transforms and Basic Probability Theory.
2. Papoulis, A., - Signal Analysis, McGraw-Hill Book Company, 1977, ISBN (10) 007-048-460-0.
3. Atkinson, K., - An Introduction to Numerical Analysis, 2nd edition, John Wiley and Sons Inc., 1989, ISBN (10) 047-162-489-6.
4. Postolache, M., - Lecture Notes in Probability & Statistics, Fair Partners, 2003, ISBN: (10) 973-847-007-2.

Final evaluation	
Evaluation method	Writen paper – 3 hours containing theory and problems
Mark components	Exam (grade E); Seminar (grade S)
Mark computation	N=0,2S + 0.8E

Course Leader

Assistant Professor Bogdan-Ionut GAVREA, Ph.D.