Politehnica University of Bucharest
Faculty of Electronics, Telecommunications and Information Technology

COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	University "Politehnica" of Bucharest
1.2 Faculty	Electronics, Telecommunications and Information Technology
1.3 Department	Applied Electronics and Information Engineering
1.4 Domain of studies	Electronic Engineering, Telecommunications and Informational Technologies
1.5 Cycle of studies	License
1.6 Program of studies/Qualification	Technologies and Systems of Telecommunications (TSTeng)

2. Course identification information

2.1 Name of the course				Decision and estimation in information processing			
2.2 Lecturer				Prof. PhD. Eng.Mihai Ciuc			
2.3 Instructor for practical activities				Assoc. Prof. PhD. Eng. Corneliu Florea			
2.4 Year of studies	III	2.5 Semester	6	2.6 Evaluation type	Exam	2.7 Course choice type	Mandatory

3. Total estimated time (hours per semester for academic activities)

3.1 Number of hours per week, out of which	5	3.2 course	3	3.3 practical activities	1/1
3.4 Total hours in the curricula, out of which	70	3.5 course	42	3.6 practical activities	14/14

Distribution of time	hours
Study according to the manual, course support, bibliography and hand notes	60
Supplemental documentation (library, electronic access resources, in the field, etc)	5
Preparation for practical activities, homeworks, essays, portfolios, etc.	5
Tutoring	0
Examinations	20
Other activities	0

3.7 Total hours of individual study	60
3.9 Total hours per semester	80
3. 10 Number of ECTS credit points	5

4. Prerequisites (if applicable)

4.1 curricular	Information theory, Linear algebra, probability theory
4.2 competence-based	Programming languages, Fourier series decompositioon

5. Requisites (if applicable)

5.1 for running the course	Does not apply
5.2 for running of the applications	Lab presence mandatory

6. Specific competences

Professional competences	Dealing with scientific, engineering and informatics fundamentals. Dealing with fundamentals of devices, circuits and electronic instrumentation Applying basic signal acquisition and processing methods in typical situations.
Transversal competences	-

7. Course objectives (as implied by the grid of specific competences)

7.1 General objective of the course	Study of basic principles of information processing in random processes. Forming the abilities of measuring and evaluating random processes towards achieving reliable information transmission chains. Basics of random signal processing in the presence of noise, e.g., statistical decision, parameter estimation, linear filtering of random processes. Applications aim at students getting a hands-on understanding of taught theoretical notions. Students are also guided towards understanding of practical importance of statistical signal processing, by pointing out the practical applications of presented methods.
4.2 Specific objectives	Developing in students the ability of using random processes knowledge in designing specific signal processing hardware, towards retrieving information in the presence of strong perturbations. Developing in students the ability to apply characteristic procedures for statistical decision, parameter estimation, optimal signal filtering

8. Content

8.1 Lectures	Teaching techniques	Remarks
Random variables: statistical characterization, moments, functions of one random variables	Teaching techniques are classical, chalk-and-blackboard based.	6h
Characterization of a pair of random variables: joint moments, functions of two random variables, central limit theorem, regression, correlation coefficient.		6h
Stochastic processes: statistical characterization of order I and II, stationarity, ergodicity, mean ergodicity theorem		6h
Spectral characterization of random processes:		6h

power spectral density, Wiener-Hincin theorem, linear filtering of random processes, adapted filter.		
Statistical decision: Bayes criterion		3h
Parameter estimation: maximum a posteriori and square estimator, maximum-likelihood estimator, estimator quality		3h
Stochastic models: discrete-time signals, AR, MA, ARMA models, Yule-Walker equations		3h
Optimal signal filtering (Wiener filters): problem posing, orthogonality principle, Wiener-Hopf equations, FIR filters case; application: prediction, noise cancelling		3h
Unitary transforms: physical interpretation, optimal Karhunen-Loève transform, discrete cosine transform		3h
Signal quantization: uniform quantization, optimal Lloyd-Max quantizer, compandation		3h
Bibliography: 1) M. Ciuc, C. Vertan: Prelucrarea statistică a semnalelor, Ed. MatrixROM, Bucureşti, 2005. 2) Al. Spătaru: Teoria transmisiunii informaţiei, Editura Tehnica şi Pedagogică, 1983 3) A. Papoulis: Probability, random variables and stochastic processes (third edition), McGraw-Hill, 1991 4) Course site: http://alpha.imag.pub.ro		
8.2 Practical applications	Teaching techniques	Remarks
Random variables	All labs are held using Matlab simmulations.	2h
Pairs of random variables		2h
Stochastic processes		2h
Wiener-Hincin theorem		2h
Statistical decision		2h
Parameter estimation		2h
Final lab exam		2h
8.3 Tutorial	Teaching techniques	Remarks
Random variables	Teaching techniques are classical, chalk-and-blackboard based.	2h
Functions of one random variable		2h
Pairs of random variables		2h
Stochastic processes: stationarity, autocorrelation function		2h
Wiener-Hincin theorem, linear filtering of stochastic processes		2h
Statistical decision		2h
Parameter Estimation		2h

Bibliography

1) C. Vertan, I. Gavăt, R. Stoian: Variabile şi procese aleatoare: principii şi aplicaţii, Ed. Printech, 1999
2) Course site: http://alpha.imag.pub.ro

9. Bridging the course content with the expectations of the epistemic community representatives, professional associations and employers representatives for the domain of the program

Notions taught at DEPI course have a wide variety of applications, being used in extremely different domains (data classification, pattern recognition, image processing and computer vision, data compression, data communications, television etc.)
The course curriculum is thought such as to allow students recognize any of the taught problems regardless of the domain where it has been encountered and adapt it to its context.
Thus graduates are given competences which are tightly related to the necessities of current qualifications and also modern technical and scientific training which enables them to find good jobs after graduation.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final mark
10.4 Lectures	We aim to test students' acquiring basic notions; to this end, students will answer a number of questions formulated specifically to test students' understanding and to discourage undigested memorization.	Written exam	30%
	We test students' capacity of working out real practical problems related to taught topics.	Written exam	30%
10.5 Practical applications	Students' capability of solving random-processes related problems are tested.	Written mid-term exam	20%
	Students' ability of practically manipulating random processes. aleatoare	Lab test at the end of the term.	20%
10.6 Minimal performance standard			
The ability to identify a statistical signal processing issue (decision, estimation, filtering etc.) in a given practical problem and to identify possible workable solutions.			

Date	Lecturer	Instructor for practical activities
09.09.2017	Prof. PhD. Eng. Mihai Ciuc	Assoc. Prof. PhD. Eng. Corneliu Florea

Date of department approval
25.09.2017

Director of Department,
Prof. PhD. Eng, Sever Pasca