UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH

Course guide
230087 - PIE - Probability and Statistics

Last modified: 13/06/2023

Unit in charge:	Barcelona School of Telecommunications Engineering
Teaching unit:	749 - MAT - Department of Mathematics.

Degree:	BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Compulsory subject).

Academic year: 2023   **ECTS Credits:** 6.0   **Languages:** Catalan

LECTURER

Coordinating lecturer:	Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura
Others:	Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma

PRIOR SKILLS

Calculus of one and several variables. Linear algebra.

REQUIREMENTS

VECTOR CALCULUS - Precorequisite

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Transversal:
07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

TEACHING METHODOLOGY

- Lectures.
- Application classes.
- Exercises.

LEARNING OBJECTIVES OF THE SUBJECT

Probability theory. Random variables. Concepts and methods of Statistics.

STUDY LOAD

Type	Hours	Percentage
Hours large group	65,0	43.33
Self study	85,0	56.67

Total learning time: 150 h

CONTENTS

1. Basic probability theory

Description:
Combinatorics: Permutations and combinations. Random experiment, sample space, random events. Probability space. Discrete spaces, Laplace formula. Continuous spaces, Borel sigma-algebra. Independence and conditional probability. Bayes Theorem and the formula of total probability. The meaning of probability.

Full-or-part-time: 15h
Theory classes: 15h

2. Random variable

Description:
Random variable. Cumulative distribution function. Discrete random variables, probability function. Examples of discrete variables (Bernoulli, geometrical, binomial, Poisson). Continuous random variables, density function. Examples of continuous variables (uniform, exponential, gaussian). DeMoivre-Laplace Theorem. Conditional density. Functions of one random variable (discrete case, continuous case, special cases). Statistical parameters: Mean, variance, standard deviation. Moments and centred moments. Chebyshev's inequality. Law of large numbers.

Full-or-part-time: 15h
Theory classes: 15h

3. Several random variables

Description:
Several random variables. Joint cumulative distribution function. Discrete case, joint probability function. Continuous case, joint density function. Examples of multidimensional variables (multinomial, uniform, gaussian). Marginal distributions. Independence of random variables. Conditional distributions. Functions of several variables. Sum of random variables: convolution theorem. Change of variables. Theorem of the mean. Covariance and correlation coefficient. Orthogonality, uncorrelation and independence. Estimation of random variables. Linear estimation. Orthogonality principle.

Full-or-part-time: 17h
Theory classes: 17h

4. Statistics

Description:
Relevant random variables in statistics: n-dimensional Gaussian, Khi square, Student's t, Fisher's F. Central Limit Theorem. Populations and samples. Descriptive statistics (histograms, boxplots, scatterplots). Statistical samples: distribution and parameters. Estimation of parameters: method of the moments and method of maximum likelihood. Confidence intervals (for the mean, for the variance, for proportions, for comparing populations). Test of statistical hypotheses. P-Values. Fitting lines. Regression in one and several variables. Statistical properties of the correlation coefficients. ANOVA.

Full-or-part-time: 18h
Theory classes: 18h

GRADING SYSTEM

Midterm exams: 40%
Final exam: 60%

BIBLIOGRAPHY

Basic:

- Leon-Garcia, A. Probability, statistics and random processes for electrical engineering. 3rd ed. Upper Saddle River, NJ: Pearson Education, 2009. ISBN 9780137155606.
- Ross, S.M. Introduction to probability and statistics for engineers and scientists. 5th ed. Oxford: Academic Press, 2014. ISBN 9780123948113.

Complementary:

- Walpole, Ronald E ... [et al.]. Probabilidad y estadística para ingeniería y ciencias [on line]. 9a.. México: Pearson Education, 2012 [Consultation: 24/11/2020]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6766. ISBN 9786073214179.

RESOURCES

Other resources:

Aroca, J.M. Probabilitat i processos estocàstics, notes de classe ETSETB.
Aroca, J.M. Estadística, notes de classe ETSETB.
Problems set.