



Course guides

230087 - PIE - Probability and Statistics

Last modified: 29/04/2020

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: 2020 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Fabrega Canudas, Jose

Others: Miquel À. Fiol
Josep Fàbrega
Anna Lladó
Gracia Sabate, Francesc Xavier

PRIOR SKILLS

Calculus of one and several variables. Linear algebra.

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). Theorem of DeMoivre-Laplace. Conditional density. Functions of one random variable (discrete case, continuous case, special cases). Statistical parameters: Mean, variance, standard deviation. Moments and centered 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, incorrelation and independence. Estimation of random variables. Linear estimation. Orthogonality principle.

Full-or-part-time: 17h

Theory classes: 17h

4. Statistics

Description:

Random variables relevant in statistics: n-dimensional Gaussian, Chi 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

Partial 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. 9a.. México: Pearson Education, 2012. ISBN 9786073214179.