UAB
Universitat Autònoma de Barcelona

Probability and Stochastic Processes

Code: 107844
ECTS Credits: 6

2025/2026

Degree	Type	Year
Electronic Engineering for Telecommunications	FB	1
Telecommunication Systems Engineering	FB	1

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Differential and integral calculus.

Objectives and Contextualisation

To familiarize the student with the techniques and methods of probabilistic modeling using random variables and stochastic processes. To develop the ability to apply these techniques in the resolution of practical problems, common in the engineering profession, for which a probabilistic mathematical model can provide a more appropriate solution than a deterministic model.

Learning Outcomes

1. KM02 (Knowledge) Interpret random phenomena using probability theory and statistics
2. KM02 (Knowledge) Interpret random phenomena using probability theory and statistics
3. SM02 (Skill) Evaluate probabilities in random events in telecommunications engineering.
4. SM02 (Skill) Evaluate probabilities in random events in telecommunications engineering.
5. SM03 (Skill) Evaluate statistical parameters of variables and processes in telecommunications engineering.

6. SM03 (Skill) Evaluate statistical parameters of variables and processes in telecommunications engineering.
7. SM04 (Skill) Express oneself appropriately using the basic mathematical language in telecommunications engineering.
8. SM04 (Skill) Express themselves appropriately using basic mathematical language in telecommunications engineering.

Content

1. Probability

- Randomness, probability spaces and Kolmogorov's axioms

- Combinatorics

- Independence and conditional probability

- Total probability formula and Bayes' formula.

2. Discrete random variables

- Probability and distribution functions

- Expectation, variance and standard deviation

- Binomial, geometric, Poisson and other distributions

3. Continuous random variables

- Density and distribution functions

- Expectation, variance and standard deviation

- Chebyshev's inequality

- Exponential, uniform, normal and other distributions

4. Convergence of sequences of random variables

- Law of large numbers

- Central limit theorem. Approximations to the normal.

5. Random vectors

- Joint and marginal distribution of two or more random variables

- Conditional distributions. Independence

- Conditional expectation, covariance and correlation coefficient

- Bivariate and multivariate normal distribution

6. Stochastic processes

- Basic definitions: trajectories and finite-dimensional distributions

- Strictly stationary (SS) and weakly stationary (WS) processes

- Cyclo-stationary processes

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Problem classes	12	0.48	KM02, KM02, SM02, SM03, SM04
Theory classes	36	1.44	KM02, KM02, SM02, SM03, SM04
Type: Autonomous			
Student's individual work	94	3.76	KM02, KM02, SM02, SM03, SM04

The subject has three hours of theory per week. They will be taught in the traditional way with a blackboard. In these classes, the main ideas on the various topics will be given, showing examples and applications. The student will receive lists of exercises and problems that will be worked on in the weekly problem class. Previously, during their non-face-to-face activity, they will have to read and think about the proposed exercises and problems.

The UAB virtual campus will be used regularly to communicate with students and to share useful materials for the course.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Problems evaluation-1	10%	1	0.04	KM02, SM02, SM03, SM04
Problems evaluation-2	10%	1	0.04	KM02, SM02, SM03, SM04
Test 1	40%	3	0.12	KM02, SM02, SM03, SM04
Test 2	40%	3	0.12	KM02, SM02, SM03, SM04

There will be four grades (over 10) to evaluate the course continuously:

- Partial Exam 1 (EP1) and Partial Exam 2 (EP2). Problems similar to those worked on during the problem classes and some theoretical questions will have to be solved.
- Problem Assessment 1 (AP1) and Problem Assessment 1 (AP2). Multiple-choice exams on basic content worked on in the subject.

The course grade (Q) will be obtained using the formula,

Q = 0.4 EP1+0.4 EP2+0.1 AP1+0.1 AP2

Students who obtain Q>=5 will have passed the subject and will have this course grade.

For students who do not pass, there will be a single retake exam that will be on the entire course subject, with a grade of Q2, over 10, which will replace the four continuous assessment tests. To pass the subject, Q2 must be greater than or equal to 5.

Honors grades will be assigned only by continuous assessment among the students with the best grades.
A student who only takes one of the four continuous assessment tests will have the grade of "No avaluable".
During the assessment tests, any act of plagiarism, copying or allowing copying will imply a grade of zero in that test, without prejudice to other possible disciplinary measures.
There is no differentiated treatment for repeating students.
There are no classes with mandatory attendance.
The use of AI is seen as an additional support for learning and can be used as long as it is specified when it has been used.
This subject does not provide for the single evaluation system.

Bibliography

BASICS:

X. Bardina, Càlcul de Probabilitats, Materials 139, Servei de Publicacions UAB, 2004.
F. Montes Suay. Procesos Estocásticos para Ingenieros: Teoría y Aplicaciones. Open notes published by the Universitat de València

COMPLEMENTARY
R. Delgado, Probabilidad y Estadística para Ciencias e Ingenierías. Delta Publicaciones. 2008.
A. León-Garcia, Alberto. Probability, statistics and random proceses for electrical engineering. 3a ed. Upper Saddle River: Pearson Education, 2009.

Software

No specific software will be used.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	311	Catalan/Spanish	second semester	morning-mixed
(PAUL) Classroom practices	312	Catalan/Spanish	second semester	morning-mixed
(PAUL) Classroom practices	331	Catalan/Spanish	second semester	morning-mixed
(PAUL) Classroom practices	332	Catalan/Spanish	second semester	morning-mixed
(TE) Theory	31	Catalan/Spanish	second semester	morning-mixed
(TE) Theory	33	Catalan/Spanish	second semester	morning-mixed