



DEGREE CURRICULUM  
**STATISTICAL METHODS**

Coordination: CONDE COLOM, JOSEP

Academic year 2023-24

## Subject's general information

<b>Subject name</b>	STATISTICAL METHODS			
<b>Code</b>	102103			
<b>Semester</b>	2nd Q(SEMESTER) CONTINUED EVALUATION			
<b>Typology</b>	<b>Degree</b>	<b>Course</b>	<b>Character</b>	<b>Modality</b>
	Bachelor's Degree in Automation and Industrial Electronic Engineering	2	COMMON/CORE	Attendance-based
	Bachelor's Degree in Energy and Sustainability Engineering	2	COMMON/CORE	Attendance-based
	Bachelor's Degree in Mechanical Engineering	2	COMMON/CORE	Attendance-based
	Common branch in industrial engineering programs - Lleida	2	COMMON/CORE	Attendance-based
	Double bachelor's degree: Degree in Mechanical Engineering and Degree in Energy and Sustainability Engineering	2	COMMON/CORE	Attendance-based
<b>Course number of credits (ECTS)</b>	6			
<b>Type of activity, credits, and groups</b>	<b>Activity type</b>	<b>PRAULA</b>		<b>TEORIA</b>
	<b>Number of credits</b>	3		3
	<b>Number of groups</b>	3		3
<b>Coordination</b>	CONDE COLOM, JOSEP			
<b>Department</b>	MATHEMATICS			
<b>Teaching load distribution between lectures and independent student work</b>	40% 60%			
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.			
<b>Language</b>	Catalan			
<b>Distribution of credits</b>	Josep Conde Colom 12 Núria Nievas Viñals 6			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
CONDE COLOM, JOSEP	josep.conde@udl.cat	12	
NIEVAS VIÑALS, NURIA	nuria.nievas@udl.cat	6	

## Subject's extra information

We recommend a continuous work during the whole semester so as to get the objectives of the subject. We also recommend to visit regularly the virtual campus since the relevant information is announced there. The personal e-mail of the lecturers is the preferred way of contacting them (avoid using the virtual campus messaging tool).

## Learning objectives

- Compute probabilities by applying events algebra.
- Define a random variable and make computations through its density and distribution functions.
- Determine the distribution model of the random variable related to a random event and make computations.
- Compute representative values and graphically represent a data set.
- Determine the linearity relation between two variables, and compute their regression line.
- Understand the results obtained in applying the statistical methods explained.

## Competences

### Degree-specific competences

- **GEM1.** Ability to resolve logical problems that can arise in engineering. Aptitude to apply knowledge about lineal algebra; geometry; differential geometry; differential and integral calculus; differential equations and partial derivatives; numeric methods, numeric algorithms; statistics and optimization.

### Degree-transversal competences

- **EPS1.** Ability to resolve problems and elaborate and defend arguments inside their field of study
- **EPS5.** Ability for abstraction and critical, logical and logical reasoning.
- **EPS6.** Ability to analyse and synthesize.

## Subject contents

### 1. Probability.

- 1.1 Experiences and random events. Incompatible and independent events.
- 1.2 Probability computation. Properties.
- 1.3 Conditional probability.
- 1.4 Total and Bayes probabilities.

### 2. Random variables. General aspects.

- 2.1 From the histogram to the density function of a continuous random variable.

2.2 Discrete variables. Probability function.

2.3 Expectation and variance of a random variable. Properties.

2.4 The density function and distribution function.

### 3. Probability distribution models.

3.1 Discrete models: Binomial and Poisson.

3.2 The normal model. Central limit theorem.

3.3 Tabulation of a probability distribution function.

### 4. Exploratory data analysis. Basic tools for quality enhancement.

4.1 Basic concepts on statistical studies: population, variable, sample.

4.2 Qualitative and quantitative variables.

4.3 Data collecting and tabulation.

4.4 Methods for data representation: bars and pareto diagrams, histograms.

4.5 Bivariate diagrams.

4.6 Results interpretation.

4.7 Parameters related to a random variable distribution: mean and standard deviation. Properties.

### 5. Correlation and Regression.

5.1 Linear Relationships Between Variables.

5.2 The Linear Correlation Coefficient.

5.3 The Least Squares Regression Line.

5.4 The Coefficient of Determination.

5.5 Estimation and Prediction.

## Methodology

The activities will be divided into two complementary parts: theory and problems.

- **Lectures:** In the lectures, the concepts and relevant theoretical results illustrated with examples and exercises are introduced.
- **Problems:** In the practical part, exercises with increasing difficulty will be solved to consolidate the concepts and notions developed in the lectures. Problems with real data are included to show the power of statistical tools in engineering.
- **Evaluation:** The evaluation tests or evidence will be assessed the theoretical concepts and problem solving as described in classroom activities. There will be two written tests each with a maximum of 40% of the mark, a follow-up to a maximum of 10% of the grade and practice with statistical software also worth a 10% of the mark.

Students have the responsibility to strengthen their knowledge autonomously by using the teaching material provided or recommended by the teacher.

Practical classes will be taught in small groups of students. Smaller groups of students favors dialogue and participation.

## Development plan

Timing of the contents of the subject:

WEEK	METHODOLOGY	CONTENTS	PRESENTIAL	AUTONOMOUS WORK
1, 2	Lecture and Problem class	Probabilities	8	12
3, 4	Lecture and Problem class	Random variables. General aspects	8	12
5, 6, 7, 8	Lecture and Problem class	Probability distribution models	16	24
9,10,11	Lecture and Problems	Exploratory data analysis. Basic tools for quality enhancement	12	18
12,13	Lecture and Problems	Correlation and linear regression	8	12
14 i 15	Laboratory practices	Statistical software	8	12

## Evaluation

Timing and load percentage assessment activities:

- Week 6. Delivery of an exercise proposed by the teacher and solved at classroom by the student. This activity contributes 10% of the total mark for the course, maximum 1 point.
- Week 9. Practical examination of the content developed in the first weeks until the ninth. This activity contributes 40% of the total mark for the course, maximum 4 points.
- Week 13. Delivery of a practical test developed with a statistical software and resolved in the computer lab. This activity contributes 10% of the total mark for the course, maximum 1 point.
- Week 16. Practical examination of the content developed in the weeks of 10 to 15. This activity contributes 40% of the total mark for the course, maximum 4 points .

The final will be configured with the arithmetic sum of the marks obtained in the aforementioned activities. The course will be overcome if the mark is a value equal to or greater than five. There will recoveries of written tests of 4 points.

### Alternative evaluation

The student who has the approval to be evaluated through alternative evaluation (see requirements and procedure in the evaluation regulations) must take a single exam of all the contents of the subject, which will have a weight of 100% of the final grade.

## Bibliography

- [1] Besalú, Mireia  
Rovira, Carles  
**Probabilitats i estadística**  
Edicions Universitat de Barcelona (2013)  
ISBN: 978-84-475-3653-5
- [2] Burillo Puig, José  
Miralles de la Asunción, Alicia  
Serra Albó, Oriol  
**Probabilitat i estadística**  
Edicions UPC 2a ed. (2005)  
ISBN: 978-84-988-0257-3
- [3] Colomer Cugat, Ma. Àngels  
**Estadística Bàsica**  
Edicions de la Universitat de Lleida (1994)  
ISBN: 84-477-0422-X
- [4] Colomer, Ma. Àngels  
Latorre, Rosa  
**Curs d'estadística. Problemes**  
Edicions de la Universitat de Lleida (1999)  
ISBN: 84-8409-020-5
- [5] Forcada Plaza, Santiago  
Rubió Massegú, Josep  
**Elements d'estadística**  
Edicions UPC (2007)  
URI: <http://hdl.handle.net/2099.3/36675>  
ISBN: 9788498803969
- [6] Forner Gumbau, Òscar  
**Exercicis d'estadística i probabilitat**  
Publicacions Universitat Alacant, (2014)  
Col·lecció Joan Fuster  
ISBN: 978-84-9717-319-3
- [7] Mateo Sanz, Josep Maria  
**Estadística pràctica pas a pas**  
Editorial Universitat Rovira i Virgili  
Col·lecció Eina-e, 7, 1a ed. (2011)  
ISBN: 978-84-694-6149-5
- [8] Pozo Montero, Francesc  
Parés Mariné, Núria  
Vidal Seguí, Yolanda  
Mazaira Font, Ferran  
**Probabilitat i estadística matemàtica:  
teoria i problemes resolts**  
Iniciativa Digital Politècnica (2010)  
ISBN: 978-84-765-3575-2
- [9] Ras Sabido, Antoni  
**Estadística aplicada per a enginyeria**  
Edicions UPC (1993)  
ISBN: 978-84-9880-117-0