

## Course guide

### 340029 - ESTA-N - Statistics

**Last modified:** 19/05/2026

**Unit in charge:** Vilanova i la Geltrú School of Engineering  
**Teaching unit:** 749 - MAT - Department of Mathematics.

**Degree:** BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING AND RAILWAY SYSTEMS (Syllabus 2024). (Compulsory subject).

**Academic year:** 2026    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish

#### LECTURER

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**Coordinating lecturer:** ESTER SIMO MEZQUITA

**Others:** Primer quadrimestre:  
FRANCISCO DE ASIS LUIS AGUILO GOST - N3111, N3112  
ROGER GAVALDA ALSINA - D3011, D3012, D3021, N3021, N3211, N3212  
ESTER SIMO MEZQUITA - D3112, N3021, N3121, N3122, N3211, N3212  
ENRIC TRULLOLS FARRENY - D3012, D3021  
M. DE LAS NIEVES YBERN CARBALLO - D3011, D3211, N3011, N3111, N3112, N3121, N3122  
MARIA LUISA ZARAGOZA MONROIG - N3011, N3012, N3021

#### PRIOR SKILLS

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Ability to apply the basic tools of differential and integral calculus in one real variable.

#### REQUIREMENTS

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FOMA

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**Specific:**

1. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

**Transversal:**

2. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.  
3. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

## TEACHING METHODOLOGY

In the lectures the instructor presents some motivating ideas, the fundamental concepts and some relevant developments, intermingled with key examples and the resolution of representative problems.

In the laboratory classes, students will carry out statistical calculations using R and RStudio individually in order to solve the exercises proposed by the teaching staff and submit them for evaluation.

## LEARNING OBJECTIVES OF THE SUBJECT

- Ability to apply the basic techniques to extract statistical information from a database.
- Ability to apply the basic theory of probability
- Ability to apply the distribution models that rules random behavior.
- Ability to apply the techniques of statistical inference to find, from an observation of the population, certain characteristics of the population as a whole.
- Ability to apply regression techniques to make predictions.

## STUDY LOAD

| Type              | Hours | Percentage |
|-------------------|-------|------------|
| Hours large group | 45,0  | 30.00      |
| Self study        | 90,0  | 60.00      |
| Hours small group | 15,0  | 10.00      |

**Total learning time:** 150 h

## CONTENTS

### 1. Descriptive Statistics

#### Description:

- 1.1 Variables. Types.
- 1.2 Graphical and statistical tools for analyzing one-dimensional variables.
- 1.3 Graphic and statistical tools for analyzing two-dimensional variables.

#### Specific objectives:

Ability to use the basic techniques to extract statistical information from a database.

#### Related activities:

Activity 1

#### Related competencies :

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

#### Full-or-part-time: 15h

Laboratory classes: 6h

Self study : 9h

## 2. Probability

### Description:

- 2.1 Definition of probability
- 2.2 Conditional probability
- 2.3 Independence of events

### Specific objectives:

Understand the basic theory of probability

### Related activities:

- Activity 1
- Activity 2
- Activity 4
- Activity 5

### Related competencies :

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

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06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

### Full-or-part-time: 12h

Theory classes: 3h

Self study : 9h

## 3. Random variables

### Description:

- 3.1 Definition and types of random variables.
- 3.2 Density function and distribution function of random variables.
- 3.3 Expectation and variance of a random variable.
- 3.4 Distribution models: Binomial, Poisson, Exponential and Normal.
- 3.5 Central limit theorem.

### Specific objectives:

Understand distribution models that govern random behavior.

### Related activities:

- Activity 1
- Activity 2
- Activity 4
- Activity 5

### Related competencies :

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

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06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

### Full-or-part-time: 32h

Theory classes: 12h

Laboratory classes: 2h

Self study : 18h

#### 4. Statistical Inference

**Description:**

- 4.1 Sampling.
- 4.2 Estimation of parameters.
- 4.3 Confidence intervals.
- 4.4 Hypothesis tests.
- 4.5 One-way ANOVA.

**Specific objectives:**

To understand and apply fundamental techniques of statistical inference that allow to obtain information about a population from the analysis of representative samples

**Related activities:**

- Activity 1
- Activity 3
- Activity 4
- Activity 5

**Related competencies :**

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

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**Full-or-part-time:** 26h

Theory classes: 10h

Laboratory classes: 1h

Self study : 15h

## 5. Regression

### Description:

- 5.1 Simple linear regression model.
- 5.2 Validation of the model.
- 5.3 Transformation of variables.

### Specific objectives:

To understand and apply linear regression techniques to make predictions and validate models.

### Related activities:

- Activity 1
- Activity 3
- Activity 4
- Activity 5

### Related competencies :

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

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### Full-or-part-time: 18h

Theory classes: 4h

Laboratory classes: 2h

Self study : 12h

## ACTIVITIES

### 1: LAB TEST

**Description:**

The practical activity will take place over six 2-hour lab sessions. Each session will consist of two parts: in the first part, the instructor will provide explanations of the theoretical content of the course. In the second part, students will be required to individually solve a series of proposed questions or exercises using the R and RStudio tools. These exercises must be submitted at the end of each session for evaluation.

**Specific objectives:**

Confirm the domain of the statistical techniques using R and R-STUDIO. Promote continuous and active learning during the practical sessions.

**Material:**

A computer with R and RStudio, along with activity instructions and class materials provided by the instructors.

**Delivery:**

The written solutions for the proposed exercises.

**Related competencies :**

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

**Full-or-part-time:** 12h

Laboratory classes: 12h

### 2. FIRST THEORETICAL EXAM

**Description:**

The student will have to solve, in person and in writing, problems on the contents 2 and 3 of Probability and Random Variables.

**Specific objectives:**

- Be able to use basic Probability theory.
- Be able to use distribution models of Aleatory Variables.
- Be able to use central limit theorem.

**Material:**

Statement of test and summary table of theory

**Delivery:**

The written solutions to the proposed exercises.

**Related competencies :**

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

**Full-or-part-time:** 1h 30m

Theory classes: 1h 30m

### 3. SECOND THEORETICAL EXAM

**Description:**

The student will have to solve, in person and in writing, problems on contents 4 and 5.

**Specific objectives:**

- Be able to use statistical inference tools.
- Be able to use linear regression tools.

**Material:**

Statement of the test and summary table of theory.

**Delivery:**

The written solutions to the proposed problems.

**Related competencies :**

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

**Full-or-part-time:** 2h 15m

Theory classes: 2h 15m

### 4: FINAL EXAM

**Description:**

The student will have to solve, in person and in writing, problems about contents 2, 3, 4 and 5.

**Specific objectives:**

Be able to use the basic techniques of the subject.

**Material:**

Statement of test and summary table of theory

**Delivery:**

The written solution of the proposed problems.

**Related competencies :**

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

**Full-or-part-time:** 2h 15m

Theory classes: 2h 15m

## 5. REEVALUATION TEST

**Description:**

The student will have to solve, in person and in writing, problems about contents 2, 3, 4 and 5.

**Specific objectives:**

Be able to use the basic techniques of the subject.

**Material:**

Statement of test and summary table of theory.

**Delivery:**

The written solution of the proposed problems.

**Full-or-part-time:** 2h 15m

Theory classes: 2h 15m

## GRADING SYSTEM

A1=lab test

A2=first partial exam

A3=second partial exam

A4=final exam

A5=reevaluation test

FINAL GRADE = MAX (0.2\*A1+0.35\*A2+0.45\*A3, 0.2\*A1+0.8\*A4)

REASSESSMENT GRADE = 0.2\*A1+0.8\*A5

(all partial scores on a 0-10 scale)

## EXAMINATION RULES.

- The conditions for conducting the individual written tests will be announced with sufficient time.
- Attendance at the lab sessions is mandatory, as is the completion of the activities proposed by the teaching staff during these sessions.
- Activities 3 and 4 will be done on the same day and, therefore, only one can be done.
- Only activity 4 can be reevaluated.

## BIBLIOGRAPHY

**Basic:**

- Ras Sabidó, Antoni. Estadística aplicada per a enginyeria [on line]. Barcelona: Edicions UPC, 1993 [Consultation: 10/03/2022]. Available on: <https://upcommons.upc.edu/handle/2099.3/36689>. ISBN 8476532849.
- Devore, Jay L. Probabilidad y estadística para ingeniería y ciencias. 9a ed. México: Cengage Learning, 2016. ISBN 9786075228280.
- Anderson, David R.; Sweeney, Thomas A.; Williams, Thomas A.; Camm, Jeffrey D.; Cochran, James J.; Fry, Michael J.; Ohlmann, Jeffrey W. Statistics for business and economics. 6th edition. Andover, Hampshire: Cengage Learning, 2024. ISBN 9781473791350.

**Complementary:**

- Walpole Ronald E. [et al.]. Probabilidad y estadística para ingeniería y ciencias [on line]. 8a ed. México: Pearson Educación, 2008 [Consultation: 12/02/2024]. Available on: [https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=6766](https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6766). ISBN 9789702609360.
- Peña, Daniel. Fundamentos de estadística. 4a reimpression. Madrid: Alianza Editorial, 2019. ISBN 9788420683805.