## Subject

## Fundamentals of Mathematics and Statistics I

**Year**: 1          **Credits**: 12 ECTS          **Language**: Spanish

## Competencies

**Core competences:**

CB1. Students have demonstrated knowledge and understanding in an area of study that builds on the foundation of general secondary education and is usually at a level that, while relying on advanced textbooks, also includes certain elements involving cutting-edge knowledge in their field of study

CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the skills that are typically demonstrated through the development and defence of arguments and problem solving within their field of study.

**General competences:**

CG1. Analytical thinking and ability to respond to complex challenges.

**Specific competences:**

CE3. Have statistical and mathematical skills applied to data science.

## Learning outcomes

RA1. Be able to analyse, logically and from different perspectives and disciplines, the complex challenges they face. To this end, identify which are the key and important aspects of the problem, analyse them and, after a critical and reasoned consideration, propose, in a reasoned manner, different creative and transformative alternatives/solutions.

RA10. Have statistical and mathematical skills applied to data science.

## Syllabus

**Statistics**
- Introduction
- Types of variables
- Frequency distribution. Histograms
- Measurements of position, dispersion, shape, concentration
- Outliers. Boxplots
- Relationship between two variables. Scatter plots
- Covariance correlation: Pearson, Kendall, Spearman
- Simple and multiple linear regression

**Probability**
- Introduction: probability events and definitions
- Random variables and distributions
- Central Limit Theorem
- Bayes Theorem

**Statistical inference**
- Hypothesis construction
- Sample distribution
- Contrast statistics
- Critical region
- P-value
- Type I and Type II errors
- Confidence intervals
- Statistical inference applied to linear regression.

**Linear Algebra**
- Introduction to linear algebra
- Calculation of distances
- Matrices and determinants
- Applying matrices to the solution of linear systems
- Vector spaces
- Linear applications and diagonalisation
- Matrix factorisation: SVD

## Training activities

The training activities planned for this module are the following:

- Challenge-based learning (3 ECTS)
- Teamwork (1 ECTS)
- Workshops (4 ECTS)
- Online resources (0.5 ECTS)
- Reflection (0.5 ECTS)
- Individual work (3 ECTS)

## Assessment system

Assessment will be by means of the continuous assessment system, providing constant feedback to both teachers and students on the learning process throughout the academic period:

- Learning activities involving the presentation of knowledge and individual study may be assessed by means of oral and/or written tests, which will account for a maximum of 60% of the final mark.
- The training activities aimed at acquiring the practical skills of the subjects will be assessed through the completion of various activities (assignments, case studies, challenges, etc.) accounting for at least 40% of the final mark.

Details of the assessment and marking will be made explicit in the annual academic planning of the subjects, in accordance with the teachers responsible and the determining factors of each course.

## Bibliography

- Estadística aplicada a los Negocios y a la Economía. 12th edition. Lind, D., Marchal, W. and Wathen, S., McGrawHill, México. 2005.
- Cuadras, C. M. (1988). Distancias estadísticas. Estadística Española, (119), 295-358.
- Casella, G., Fienberg, S., & Olkin, I. (2013). Springer Texts in Statistics.
- Bruce, P., Bruce, A., & Gedeck, P. (2020). Practical statistics for data scientists: 50+ essential concepts using R and Python. O'Reilly Media.
- Meyer, C. D. (2000). Matrix Analysis and Applied Linear Algebra. Society for Industrial and Applied Mathematics.
- Lehmann, E. L., & Romano, J. P. (2005). Testing Statistical Hypotheses (3rd 2005. Corr. 2nd Printing 2008 ed.). Springer.