Universidad de Navarra

Statistics and Probability

Guía docente 2025-26

PRESENTATION

Brief description:

Statistics is presented to the student as a new discipline of an applied nature.

The main **objective of** this subject is to provide the student with basic training in probability and statistics, needed to be able to suitably carry out any descriptive analysis of a set of data. To this end, the theoretical part of the course will be complemented by approaching and dealing with any problems that may facilitate its understanding. Problems will also be solved using specific statistical software that facilitates the use of a large amount of data, more in line with real problems.

There are NO prerequisites for this course.

Qualification (Module/Subject):

- Industrial Technologies Engineering (Basic Training/ Basic Mathematics)
- Mechanical Engineering (Basic Training/ Basic Mathematics)
- Electrical Engineering (Basic Training/ Basic Mathematics)
- Industrial Electronics Engineering (Basic Training/ Basic Mathematics)
- Telecommunication Systems Engineering (Basic Training/ Mathematics and Computer Science)
- Industrial Management Engineering (Basic Training/ Basic Mathematics)
- Industrial Design and Product Development Engineering (Basic Training/ Basic Mathematics)
- Biomedical Engineering (Basic Training/ Basic Mathematics)
- Artificial Intelligence Engineering (Basic Training/Basic Mathematics)

Details:

- **ECTS**: 6 ECTS
- **Year, semester**: 1st year, 2nd semester
- **Character**: Basic
- **Language**: English

Lecturers in the subject:

- Blasco Aramburu, Telmo
- Fernández Duval, Gonzalo Hernán

LEARNING OUTCOMES

INDUSTRIAL TECHNOLOGIES ENGINEERING

R1 - Students will 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 which, while relying on advanced textbooks, also includes some aspects involving knowledge deriving from the cutting edge of their field of study.

R2 - Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and in partial derivatives; numerical methods; numerical algorithms; statistics and optimisation.

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MECHANICAL ENGINEERING

R1 - Students will 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 which, while relying on advanced textbooks, also includes some aspects involving knowledge deriving from the cutting edge of their field of study.

R24 - Knowledge in basic and technological subjects, which enables them to learn new methods and theories, and provides them with the versatility to adapt to new situations.

R2 - Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and in partial derivatives; numerical methods; numerical algorithms; statistics and optimisation.

ELECTRICAL ENGINEERING

R1 - Students will 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 which, while relying on advanced textbooks, also includes some aspects that involve knowledge deriving from the cutting edge of their field of study.

R2 - Knowledge in basic and technological subjects, which enables them to learn new methods and theories, and provides them with the versatility to adapt to new situations.

R3 - Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and in partial derivatives; numerical methods; numerical algorithms; statistics and optimisation.

INDUSTRIAL ELECTRONICS ENGINEERING

R1 - Students will 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 which, while relying on advanced textbooks, also includes some aspects that involve knowledge deriving from the cutting edge of their field of study.

R22 - Knowledge in basic and technological subjects, which enables them to learn new methods and theories, and provides them with the versatility to adapt to new situations.

R2 - Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and in partial derivatives; numerical methods; numerical algorithms; statistics and optimisation.

TELECOMMUNICATION SYSTEMS ENGINEERING

R1 - Students will 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 which, while relying on advanced textbooks, also includes some aspects that involve knowledge deriving from the cutting edge of their field of study (Type: Knowledge or content).

R2 - Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and in partial derivatives; numerical methods; numerical algorithms; statistics and optimisation. (Type: Knowledge or contents)

INDUSTRIAL ORGANISATION ENGINEERING

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R1 - Students will have demonstrated knowledge and understanding of in an area of study which builds on the foundation of general secondary education, and is usually at a level which, while relying on advanced textbooks, also includes some aspects involving knowledge deriving from the cutting edge of their field of study.

R2 - Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and in partial derivatives; numerical methods; numerical algorithms; statistics and optimisation.

R40 - Provide a solid foundation in science, technology, operations management, production and business management.

INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING

R1 - Students will 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 which, while relying on advanced textbooks, also includes some aspects involving knowledge deriving from the cutting edge of their field of study.

R3 - Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; numerical methods; numerical algorithms; statistics and optimisation.

BIOMEDICAL ENGINEERING

R1 - Students will 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 which, while relying on advanced textbooks, also includes some aspects involving knowledge deriving from the cutting edge of their field of study.

R31 - Training must provide the graduate Training must provide the graduate with a solid scientific base to enable them to rigorously address any professional challenges they may face in the biomedical sector.ith a solid scientific base to enable them to rigorously address any professional challenges they may face in the biomedical sector.

R23 - Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; numerical methods; numerical algorithms; statistics and optimisation.

ARTIFICIAL INTELLIGENCE ENGINEERING

R1 - Describe the fundamentals of linear algebra; geometry, differential geometry, differential and integral calculus, differential equations and in partial derivatives, numerical methods, numerical algorithms, statistics and optimisation to solve mathematical problems applied to the field of engineering (Type: Knowledge or contents).

COURSE CONTENT

1. PROBABILITY THEORY: Introduction to probability. Concept of Probability. Properties of Probability. Conditional Probability. Bayes' Theorem.

2. RANDOM VARIABLES: Concept of random variable. Discrete and continuous variables. Distribution functions. Moments of a random variable. Chebyshev's inequality. Introduction to n-dimensional variables.

3. MOST IMPORTANT DISCRETE DISTRIBUTIONS: D. Binomial. Geometric D. D. Negative Binomial. D. Hypergeometric. D. Poisson

4. MOST IMPORTANT CONTINUOUS DISTRIBUTIONS: D. Uniform. D. Gamma. D. Exponential. D. Normal. Central Limit Theorem.

5. INTRODUCTION TO DATA ANALYSIS (Practical sessions in a computer classroom): Currently using the free software R. Practical sessions on: Data grouping methods. Graphs, tables and the most common data summary values. Problem solving with specific functions of the software. Visualisation and interpretation of data.

TRAINING ACTIVITIES

Approximate breakdown of time to be set aside by the student for the subject, according to training activities:

- 50 hours of face-to-face classes (40 hours in normal classroom + 10 hours in computer classroom)
- 10 hours of seminars to cover any doubts or problems
- 2.5 hours of individual tutorials
- 3 hours of evaluable tests (within the term)
- 3 hours of final exam
- 70 hours of continuous personal study (5 hours/week)
- 25 hours of study for exams

TOTAL: 163.5 HOURS

METHODOLOGY AND TEACHING MATERIALS

For theoretical classes, students will have textbooks with which to follow the lecturer's explanations in the classroom. The lecturer will conduct the lecture with the help of the blackboard and PowerPoint.

For face-to-face problem classes, the student will have an additional list of problems for each topic that will serve as a guide for the problem seminars.

For face-to-face practical computer training classes, the student will have an R manual adapted for the subject, which will enable them to follow the explanations provided by the lecturer. They will also have a list of exercises to do in class.

In addition, the student will be given a recommended bibliography to expand on and/or review the same content or complementary content provided on this course.

EVALUATION

ORDINARY EXAMINATION SESSION

The subject will be assessed as follows:

Intermediate tests PE: (max 2.5 points of the final mark for the course).

Computer work placement PO: Computer work placement test (max. 1.5 points of the final mark for the course)

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Final exam E (max 6 points of the final mark for the course; a minimum is required in this part). Anyone could also repeat the intermediate test (2.5 points) in this exam. The second mark will be only considered.

Final mark for the subject = sum of the marks for each part = NPE+ **NPO + NE**

Conditions for PASSING: Subject mark >= 5 points (out of 10 points)

EXTRAORDINARY EXAMINATION SESSION (RESITS)

The extraordinary examination session is PASSED if:

1. The mark for the final exam, out of 10, without taking into account anything done during the course, is at least 5.0.

SPECIAL SITUATIONS

1. The impossibility of taking part specifically in any of the tests assessed during the course will be dealt with according to the criteria set out in the current academic regulations in relation to the change of dates for exams.

2. Students who for some reason are unable to follow the pace of the classes throughout the course and, therefore, cannot access the assessed tests that are carried out throughout the course, should contact the lecturers in the subject as soon as possible. Cases will be analysed on an individual basis.

DOUBT SESSIONS

The following time slots are available for doubt sessions:

Dr. Telmo Blasco Aramburu. Wednesdays 15:00-17:00. Despacho profesores Miramón. Urdaneta building (Ground Floor).

Dr. Gonzalo Hernán Fernández Duval. Thursdays, 15:00-17:00. Departamento Organización. Urdaneta building (First Floor). Use the following link

BIBLIOGRAPHY

The resources required for this course will be as follows:

Estadística Básica para Universitarios, Elisabeth Viles, EUNSA Find it in the library

Exercises in probability calculation. H. Fernández-Abascal, M. Guijarro, JL. Rojo, JA. Sanz. Editorial Ariel Matemática. Find it in the library

Any other basic statistics and probability book in the library can be used to supplement the lectures.

Lecturers will upload material to complement the face-to-face classes in the subject content area and as the course progresses.

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