# UNIVERSIDAD DE CASTILLA - LA MANCHA
## GUÍA DOCENTE

## 1. General information

**Course:** STATISTICS

**Type:** BASIC

**Degree:** 417 - UNDERGRAD. IN INDUSTRIAL ELECTRONICS AND AUTOMAT. ENGINEERING

**Center:** 602 - E.T.S. INDUSTRIAL ENGINEERING OF C. REAL

**Year:** 1

**Main language:** Spanish

**Use of additional languages:**

**Web site:**

**Code:** 56307

**ECTS credits:** 6

**Academic year:** 2023-24

**Group(s):** 20  21

**Duration:** C2

**Second language:** English

**English Friendly:** Y

**Bilingual:** N

| Lecturer: **VICTOR MANUEL CASERO ALONSO** - Group(s): **20  21** | | | | |
|---|---|---|---|---|
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| Lecturer: **IRENE GARCIA CAMACHA GUTIERREZ** - Group(s): **20** | | | | |
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| Lecturer: **RAUL RIVILLA BASTANTE** - Group(s): **20  21** | | | | |
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## 2. Pre-Requisites

In order to students achieve the described learning objectives, they must possess knowledge and skills that are supposed acquired from their pre-university education:

- Knowledge: basic mathematical operations (powers, logarithms, fractions), polynomials, matrices, derivation, integration and graphic representation of functions.
- Basic skills in managing computers.

Although there are no formal incompatibilities, for students who access a subject without having acquired the skills of the previous subjects, following the subject will be much more costly and difficult both in terms of time and effort.

## 3. Justification in the curriculum, relation to other subjects and to the profession

This course provides students with the necessary skills to face and solve the problems that a graduate can find in their work, mainly related to the analysis and treatment of data obtained empirically.

In addition, the concepts developed in this subject will be used later in compulsory subjects such as Electrical, Electronic and Automatic Technology, Manufacturing and Industrial Control Systems, and Manufacturing Technology. Some of these concepts also appear in several elective subjects.

For the Engineer, Statistics will be an essential work tool in his/her daily work. The basic responsibility of an Engineer is to lead the continuous improvement of quality and productivity in all processes that depend on him/her. But to improve processes it is necessary to change them, and these changes, if they are to be rational, can only be the result of data analysis. How to generate data that has relevant information? How to extract, by means of the adequate analysis, said information of the data? The answer to both questions is the object of Statistical Science and as a consequence every Engineer must know it and apply it in his daily work.

## 4. Degree competences achieved in this course

### Course competences

| Code | Description |
|---|---|
| CB02 | Apply their knowledge to their job or vocation in a professional manner and show that they have the competences to construct and justify arguments and solve problems within their subject area. |
| CB03 | Be able to gather and process relevant information (usually within their subject area) to give opinions, including reflections on relevant social, scientific or ethical issues. |
| CB04 | Transmit information, ideas, problems and solutions for both specialist and non-specialist audiences. |
| CB05 | Have developed the necessary learning abilities to carry on studying autonomously |
| CEB01 | Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge of linear algebra; geometry, differential geometry, differential and partial differential equations, numerical methods, numerical algorithms, statistics and optimisation. |
| CG03 | Knowledge of basic and technological subjects to facilitate learning of new methods and theories, and provide versatility to adapt to new situations. |
| CG04 | Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of industrial engineering. |
| CT02 | Knowledge and application of information and communication technology. |
| CT03 | Ability to communicate correctly in both spoken and written form. |

## 5. Objectives or Learning Outcomes

**Course learning outcomes**

Description

Knowledge of the main approaches for solving by numerical methods, user level implementation of software packages for statistics, data processing, mathematical calculation and visualisation, planning algorithms and programming using a high-level programming language, visualising functions, geometric figures and data, designing experiments, analysing data and interpreting results.

Ability to express oneself correctly orally and in writing and, in particular ability to use the language of mathematics as a way of accurately expressing the quantities and operations that appear in industrial engineering. Acquired habits of working in a team and behaving respectfully.

Knowledge and interpretation of the fundamental measures of descriptive statistics, approximate two-dimensional data by regression analysis, the fundamentals of probability, estimating parameters of statistical models, constructing confidence intervals, testing hypotheses and making decisions.

## 6. Units / Contents

**Unit 1: Descriptive Statistics: fundamentals, correlation and regression**

**Unit 2: Probability Calculus.**

**Unit 3: Statistical Inference: point estimation and confidence intervals, parametric and non-parametric hypothesis tests.**

### ADDITIONAL COMMENTS, REMARKS

**Computer labs:**

Lab 0: Introduction to the statistical software R and descriptive statistics.
Lab 1: Bivariate data, multivariate and linear regression.
Lab 2: Probability distributions and Central Limit Theorem.
Lab 3: Confidence intervals and hypothesis tests (one sample).
Lab 4: Two samples hypothesis tests.
Lab 5: Non-parametric hypothesis tests and analysis of variance.

## 7. Activities, Units/Modules and Methodology

| Training Activity | Methodology | Related Competences (only degrees before RD 822/2021) | ECTS | Hours | As | Com | Description |
|---|---|---|---|---|---|---|---|
| Class Attendance (theory) [ON-SITE] | Lectures | CG03 | 1.2 | 30 | N | - | Presentation of contents to the students. |
| Problem solving and/or case studies [ON-SITE] | Problem solving and exercises | CB02 CB03 CB04 CB05 CEB01 CG03 CG04 CT03 | 0.6 | 15 | N | - | Problem solving from a list of available exercises. |
| Class Attendance (practical) [ON-SITE] | Practical or hands-on activities | CB02 CB03 CB04 CB05 CEB01 CG03 CG04 CT02 CT03 | 0.4 | 10 | Y | N | Using R statistical software for problem solving. |
| Formative Assessment [ON-SITE] | Assessment tests | CB02 CB03 CB04 CB05 CEB01 CG03 CG04 CT03 | 0.2 | 5 | Y | Y | Final exam consists of 5 exercises: 1 related with theme 1, 1 related with theme 2, 2 related with theme 3 and a final exercise with theoretical and practical test questions and related with the R software. |
| Study and Exam Preparation [OFF-SITE] | Self-study | CB02 CB03 CB04 CB05 CEB01 CG03 CG04 CT02 CT03 | 3.6 | 90 | N | - | For each hour received of theory, problem solving, labs, etc. Dedicate 1.5 hours (study to assimilate contents, solve exercises to prepare exams...) |
| | | **Total:** | **6** | **150** | | | |
| | **Total credits of in-class work: 2.4** | | | **Total class time hours: 60** | | | |
| | **Total credits of out of class work: 3.6** | | | **Total hours of out of class work: 90** | | | |

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

## 8. Evaluation criteria and Grading System

| Evaluation System | Continuous assessment | Non-continuous evaluation* | Description |
|---|---|---|---|
| Projects | 10.00% | 0.00% | Continuous assessment: Mean of the projects elaborated by the students. |
| Final test | 65.00% | 75.00% | Continuous assessment: Written exam with theoretical-practical questions. Non-continuous evaluation: In addition to the written exam, the student must submit and defend a paper based on a dataset provided by the teachers. |
| Assessment of activities done in the computer labs | 25.00% | 25.00% | Continuous assessment: Average of the evaluation sessions of computer labs. Non-continuous assessment: Computer labs exam, the same day as the final exam. |
| **Total:** | **100.00%** | **100.00%** | |

*According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of*

*the competences).*

**Evaluation criteria for the final exam:**

**Continuous assessment:**
Correct approach to solve the questions.
Correct results.
Correct written expression.
Minimum grade to pass the subject: 5 points out of 10.

**Non-continuous evaluation:**
Correct approach to solve the questions.
Correct results.
Correct written expression.
Minimum grade to pass the subject: 5 points out of 10.

**Specifications for the resit/retake exam:**

Same as final exam.

**Specifications for the second resit / retake exam:**

Same as final exam.

## 9. Assignments, course calendar and important dates

### Not related to the syllabus/contents

| Hours | hours |
|---|---|
| Class Attendance (theory) [PRESENCIAL][Lectures] | 30 |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 15 |
| Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities] | 10 |
| Formative Assessment [PRESENCIAL][Assessment tests] | 5 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 90 |

### Global activity

| Activities | hours |
|---|---|
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 15 |
| Formative Assessment [PRESENCIAL][Assessment tests] | 5 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 90 |
| Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities] | 10 |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 30 |
| | **Total horas:** 150 |

## 10. Bibliography and Sources

| Author(s) | Title/Link | Publishing house | City | ISBN | Year | Description |
|---|---|---|---|---|---|---|
| López Cano, Emilio | Estadística empresarial https://www.lcano.com/b/eee/_book/ | | | | 2020 | |
| Devore, Jay L. | Probabilidad y estadística para ingeniería y ciencias | Thomson | | 970-686-457-1 | 2005 | Libro de teoría |
| Fernández Guerrero, Mercedes | Manual de estadística para ingenieros | Casa Ruiz Morote | | 84-934398-2-8 | 2007 | |
| García Pérez, Alfonso | Ejercicios de estadística aplicada | Universidad Nacional de Educación a Distancia | | 978-84-362-5547-8 | 2008 | Libro de problemas |
| Letón Molina, Emilio et al. | Mini-Vídeos de autoformación https://media.uc3m.es/series/5b30126d8f420862d08b47ac | | | | | |
| Novo Sanjurjo, Vicente | Problemas de cálculo de probabilidades y estadística | Sanz y Torres | | 84-96094-14-6 | 2003 | Libro de problemas |
| Verzani, John | Using R for introductory statistics | Chapman and Hall/CRC | | 1-58488-450-9 | 2005 | Libro de prácticas de ordenador |
| López Cano, Emilio | Análisis de datos con R aplicado a la economía, la empresa y la industria https://www.lcano.com/b/adr/_book/ | | | | 2019 | |
| Peña Sánchez de Rivera, Daniel | Regresión y diseño de experimentos | Alianza Editorial | | 978-84-206-9389-7 | 2002 | Libro de teoría, con ejercicios resueltos |
| Peña Sánchez de Rivera, Daniel | Fundamentos de estadística | Alianza Editorial | | 978-84-206-8380-5 | 2008 | Libro de teoría, con ejercicios resueltos |
| Walpole, Ronald E. | Probabilidad y estadística para ingeniería y ciencias | Pearson Educación | | 978-970-26-0936-0 | 2007 | Libro de teoría |
| Montgomery, Douglas C. | Probabilidad y estadística aplicadas a la ingeniería | Limusa Wiley | | 978-968-18-5915-2 | 2007 | Libro de teoría, con ejercicios resueltos |
| Arriaza Gómez, Antonio J. et al. | Estadística básica con R y R-Commander http://knuth.uca.es/ebrcmdr | Servicio de Publicaciones de la Universidad de Cádiz | | 978-84-9828-186-6 | 2008 | Libro de prácticas de ordenador |