



## 1. General information

Course: STATISTICS

Type: BASIC

Degree: 359 - UNDERGRAD. IN INDUSTRIAL ELECTRONICS AND AUTOMAT. ENGINEERING (CR)

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: 2022-23

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: 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.

## 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
A01	To understand and have knowledge in an area of study that moves on from the general education attained at secondary level and usually found at a level that, while supported in advanced text books, also includes some aspects that include knowledge found at the cutting edge of the field of study.
A02	To know how to apply knowledge to work or vocation in a professional manner and possess the competences that are usually demonstrated by the formulation and defence of arguments and the resolution of problems in the field of study.
A03	To have the capability to gather and interpret relevant data (normally within the area of study) to make judgements that include a reflection on themes of a social, scientific or ethical nature.
A07	Knowledge of Information Technology and Communication (ITC).
A08	Appropriate level of oral and written communication.
A12	Knowledge of basic materials and technologies that assist the learning of new methods and theories and enable versatility to adapt to new situations.
A13	Ability to take the initiative to solve problems, take decisions, creativity, critical reasoning and ability to communicate and transmit knowledge, skills and abilities in Industrial Electronic Engineering and Automation.
A17	Ability to apply principles and methods of quality control.
B01	Ability to solve mathematical problems that occur in engineering. Aptitude to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential and partial differential equations; numerical methods; numerical algorithms; statistics and optimization.
CB01	Prove that they have acquired and understood knowledge in a subject area that derives from general secondary education and is appropriate to a level based on advanced course books, and includes updated and cutting-edge aspects of their field of knowledge.
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.
	Be able to gather and process relevant information (usually within their subject area) to give opinions, including reflections on relevant

CB03	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

## 5. Objectives or Learning Outcomes

### Course learning outcomes

#### Description

Know and interpret the fundamental measurements of descriptive statistics, approximate bidimensional data through regression adjustment, know the fundamentals of probability, estimate the parameters of statistical models, construct confidence intervals, contrast hypotheses and take decisions.

Know the main approaches for resolution through using numerical methods, to use some statistical software packages at user level, data processing, mathematical calculus and visualization, set out algorithms and program through programming language of a high level, visualize functions, geometric figures and data, design experiments, analyze data and interpret results

Be able to express yourself correctly both orally and in writing, and, in particular, to know how to use mathematical language to express with precision quantities and operations that appear in industrial engineering. Become accustomed to working in a team and behaving respectfully.

## 6. Units / Contents

### Unit 1: Descriptive Statistics.

**Unit 1.1** Frequency distributions.

**Unit 1.2** Graphical representation.

**Unit 1.3** Statistical measures.

**Unit 1.4** Bidimensional distributions. Regression and correlation.

### Unit 2: Probability Calculus.

**Unit 2.1** Probability concepts and properties.

**Unit 2.2** Random variables.

**Unit 2.3** Moments of random variables.

**Unit 2.4** Remarkable distributions of random variables.

### Unit 3: Statistical Inference.

**Unit 3.1** Statistical Inference. Point estimation.

**Unit 3.2** Confidence Interval estimation.

**Unit 3.3** Parametric Hypothesis Test.

**Unit 3.4** Nonparametric methods.

**Unit 3.5** Analysis of Variance.

**Unit 3.6** Design of experiments.

## ADDITIONAL COMMENTS, REMARKS

### Computer labs:

Lab 1: Introduction to the statistical software R and Descriptive Statistics.

Lab 2: Bivariate data, Multivariate and Linear Regression.

Lab 3: Probability distributions and Central Limit Theorem.

Lab 4: Confidence Intervals and Hypothesis tests (parametrics).

Lab 5: Parametric and nonparametric Hypothesis test.

Lab 6: 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	A01 A12 CB01	1.04	26	N	-	Presentation of contents to the students.
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	A02 A03 A08 A12 A13 B01 CB02 CB03 CB04 CB05	0.64	16	N	-	Problem solving from a list of available exercises.
Computer room practice [ON-SITE]	Practical or hands-on activities	A01 A02 A03 A07 A08 A12 A13 A17 B01 CB01 CB02 CB03 CB04 CB05	0.48	12	Y	N	Using R statistical software for problem solving.
Individual tutoring sessions [ON-SITE]		A01 A02 A03 A07 A08 A12 A13 A17 B01 CB01 CB02 CB03 CB04 CB05	0.04	1	N	-	For solving doubts, ask for problem solving.
Progress test [ON-SITE]	Assessment tests	A02 A03 A08 A12 A13 A17 B01 CB02 CB03 CB04 CB05	0.08	2	Y	N	1 or 2 progress test similar to the final exam.
Final test [ON-SITE]	Assessment tests	A02 A03 A08 A12 A13 A17 B01 CB02 CB03 CB04 CB05	0.12	3	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	A01 A02 A03 A07 A08 A12 A13 A17 B01 CB01 CB02 CB03 CB04 CB05	3.6	90	N	-	
<b>Total:</b>			<b>6</b>	<b>150</b>			
<b>Total credits of in-class work: 2.4</b>			<b>Total class time hours: 60</b>				

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
Other methods of assessment	10.00%	10.00%	Individual or team work supervised. (Computer labs and progress test)
Final test	90.00%	90.00%	Mean of the 5 final exam exercises/questions.
<b>Total:</b>	<b>100.00%</b>	<b>100.00%</b>	

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 of the problems.
- Correct results.
- Correct written expression.
- Minimum grade to pass the subject: 5 points out of 10.

#### Non-continuous evaluation:

- Correct approach of the problems.
- 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
Individual tutoring sessions [PRESENCIAL][ ]	1
Final test [PRESENCIAL][Assessment tests]	3
Unit 1 (de 3): Descriptive Statistics.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	6
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	4
Computer room practice [PRESENCIAL][Practical or hands-on activities]	4
Progress test [PRESENCIAL][Assessment tests]	.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	20
Unit 2 (de 3): Probability Calculus.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	6
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	4
Computer room practice [PRESENCIAL][Practical or hands-on activities]	2
Progress test [PRESENCIAL][Assessment tests]	.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	20
Unit 3 (de 3): Statistical Inference.	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	14
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	8
Computer room practice [PRESENCIAL][Practical or hands-on activities]	6
Progress test [PRESENCIAL][Assessment tests]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	50
Global activity	
Activities	hours
Progress test [PRESENCIAL][Assessment tests]	2
Class Attendance (theory) [PRESENCIAL][Lectures]	26
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	16
Computer room practice [PRESENCIAL][Practical or hands-on activities]	12
Individual tutoring sessions [PRESENCIAL][ ]	1
Final test [PRESENCIAL][Assessment tests]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
<b>Total horas: 150</b>	

## 10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Ardanuy Albajar, Ramón	Estadística para ingenieros	Hespérides		84-604-7675-8	1998	Libro de Teoría
Arriaza Gómez, A.J. et al.	Estadística básica con R y R-Commander <a href="http://knuth.uca.es/ebrcmdr">http://knuth.uca.es/ebrcmdr</a>	Servicio de Publicaciones de la Universidad de		978-84-9828-186-6	2008	Libro de Prácticas de Ordenador
CUADRAS, Carles M.	Problemas de probabilidades y estadística	EUB		84-89607-09-5 (o.c.)	1995	Libro de Problemas
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, Emilio et al.	Mini-Vídeos de autoformación <a href="http://minivideos.uc3m.es/">http://minivideos.uc3m.es/</a>					
Montgomery, Douglas C.	Probabilidad y estadística aplicadas a la ingeniería	McGraw-Hill		970-10-1017-5	1996	Libro de Teoría
Novo Sanjurjo, Vicente	Problemas de cálculo de probabilidades y estadística	Sanz y Torres		84-96094-14-6	2003	Libro de Problemas
Peña, Daniel	Fundamentos de estadística	Alianza Editorial		84-206-8696-4	2001	Libro de Teoría
Peña, Daniel	Regresión y diseño de experimentos	Alianza Editorial		84-206-8695-6	2002	Libro de Teoría
Sarabia Viejo, Angel	Problemas de probabilidad y estadística : elementos teóricos	Clagsa		84-604-5619-6	1993	Libro de Problemas
Verzani, John	Using R for introductory statistics	Chapman and Hall/CRC		1-58488-450-9	2005	Libro de Prácticas de Ordenador
Walpole, Ronald E.	Probabilidad y estadística para ingenieros	Prentice-Hall Hispanoamericana		970-17-0264-6	1999	Libro de Teoría