Teaching Guide				
Identifying Data				2022/23
Subject (*)	Statistical data analysis		Code	730495005
Study programme	Mestrado Universitario en Materiais Complexos: Análise Térmica e Reoloxía (plan 2012)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Obligatory	3
Language	English			
Teaching method	Face-to-face			
Prerequisites				
Department	Matemáticas			
Coordinador	Naya Fernandez, Salvador	E-mail	salvador.naya@udc.es	
Lecturers	Francisco Fernandez, Mario Naya Fernandez, Salvador	E-mail	mario.francisco@udc.es salvador.naya@udc.es	
Web	www.udc.es			
General description	This subject is to provide students with skills processing of statistical data, regression models, numerical methods.			

Study programme competences / results	
Code	Study programme competences / results
A4	Knowing and applying statistical methods to analyze data from complex material testing
B2	The students have the skill to apply their knowledge and their ability to solve problems in new or unfamiliar contexts within broader (or multidisciplinary) contexts related to their field of study
B3	That students are able to integrate knowledge and handle complexity, and formulate judgments from an information that, being limited or not complete, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments
B4	That the students can communicate their conclusions and the knowledge and last reasons behind that conclusions to specialized and non specialized audience in a clear and unambiguous way
B7	Solving problems effectively
B9	To work autonomously with initiative
B12	Communicate effectively in the work environment
B13	Analysis-oriented attitude
B18	Ability for abstraction, understanding and simplification of complex problems
C2	Have a good command of spoken and writing expression and understanding of a foreign language.
C4	Developing for the exercise of an open, educated, critical, committed, democratic and solidary citicenship, able to analyze reality, diagnose problems, formulate and implement solutions based on knowledge and oriented to the common good.
C6	Critically assessing the knowledge, technology and information available to solve the problems they face with.
C7	To assume as a professional and citizen the importance of learning throughout life.
C8	To assess the importance of research, innovation and technological development in the socio-economic and cultural progress of society.

Learning outcomes			
Learning outcomes	Study programme competences / results		
To train students in theoretical and methodological principles for quantitative research, in the sense of design of experiments and regression models	AR4	BR2 BR18	CR6 CR8
Know the most common statistical techniques in the field of thermal analysis and rheology	AR4	BR13 BR18	
Knowing and applying statistical methods to analyze data from complex material testing	AR4	BR2 BR3 BR9	CR7

To know the main research methods and techniques to design a laboratory experiment in Thermal Analysis and Rheology and the subsequent modelling of the results.	AR4	BR2 BR4 BR7 BR12 BR13	CR2 CR4

Contents	
Topic	**Sub-topic**
The following blocks or topics develop the contents established in the Verification Report, which are:	Design of Experiments (Basic Principles, ANOVA model, factorial designs, repeated measurements designs, RyR laboratory design) Regression Analysis (Simple linear regression, general linear regression: multiple regression, diagnosis of atypical or influential observations, construction of a regression model, nonlinear regression). Applications in thermal analysis and rheology data
I. Exploratory Data Analysis	1.1. Introduction to statistical analysis 1.2. Frequency distributions. 1.3. Graphical plots. 1.4. Characteristic measures: Measures of location, variability and shape. 1.5. Vectors of variables. 1.6. Frequency distribution of bivariate vectors. 1.7. Graphical plots of bivariate vectors. 1.8. Characteristic measures of bivariate vectors.
II. Statistical inference	2.1. Introduction. 2.2. Point estimation. 2.3. Confidence Intervals. 2.4. Hypothesis testing.
III. Regression Models	3.1. Introduction. 3.2. Simple linear regression models. 3.3. Parameter estimation by least squares. 3.4. Properties of the estimators. 3.5. Inference for the parameters. 3.6. Validation of a regression model. 3.7. Correlation. 3.8. Other regression models.
IV. Design and Analysis of Experiments	4.1. Basic principles of design of experiments. 4.2 Planning stages of an experiment. 4.3. Designs with a source of variation. The ANOVA model. 4.4. Designs with several factors. Factorial designs. 4.5. Factorial designs and response surfaces. 4.6. Experimental designs applications to complex materials.

Planning				
Methodologies / tests	**Competencies / Results**	**Teaching hours (in-person & virtual)**	**Student?s personal work hours**	**Total hours**
Guest lecture / keynote speech	A4 B2 B3 B4 B6	10	13	23
Supervised projects	C2 C4 C6 C7 C8	5	20	25
ICT practicals	B7 B12 B13	2	12	14
Objective test	A4 B2 B9 B18	2	8	10
Personalized attention		3	0	3
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Guest lecture / keynote speech	Students will receive lectures where the professor, with the help of relevant audiovisual media, will present the theoretical and practical contents of the subject. Participation and debate will be encouraged at all times.
Supervised projects	Methodology designed to promote independent learning of students under the tutelage of a Professor and in various settings (academic and professional). It refers primarily to learning "how to do things."
ICT practicals	Methodology that allows students to effectively learn through practical activities (proofs, simulations, data analysis using statistical packages, etc.) the theory of a field of knowledge, using information technology and communications . ICT brings excellent support and a channel for information processing and practical application of knowledge, facilitating learning and skills development by students.
Objective test	Multiple choice test of basic issues matter.

Personalized attention	
Methodologies	**Description**
Guest lecture / keynote speech Supervised projects	Resolution of doubts, clarifications, etc. Analysis and critical evaluation of scientific literature. Help your approach and follow up. Personal monitoring of each stage of the course work set (individual or group). Accompanying the students with explanations.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Guest lecture / keynote speech	A4 B2 B3 B4 B6	Theoretical explanation of nuclear issues or basic notions of the subject. Attendance and monitoring by students at these sessions (continuous evaluation) compute in the final grade. For enrolled part-time students, this percentage of the mark may be less than 20%.	20
Supervised projects	C2 C4 C6 C7 C8	Methodology designed to promote independent learning and in group of students, based on the assumption by the students of responsibility for their own learning under the tutelage of Professor in various settings (academic and professional). It refers primarily to the learning of "how to do things".	40
ICT practicals	B7 B12 B13	Included the presentations that students do of the various mentored works. It deals with fundamental questions of the subject using ICT, particularly the use of statistical programs for data processing. Through a small group or individual tutoring, the teacher will guide the process of carrying out the work as non-presential methodology, based on the practices performed during the course.	20
Objective test	A4 B2 B9 B18	Examination of the concepts covered in the course.	20
Others			

Assessment comments

The presentation by the student of the course work posed in the subject must be done at least on the official date of the examination of the subject for each one of the calls the student attends.
The evaluation system in the case of academic exemption will be the same as the one described in this section.
The criteria for evaluating the second opportunity are the same as those for the first opportunity.
The fraudulent performance of the tests or evaluation activities will directly imply the grade of failure (0) in the subject.

Sources of information	
Basic	- Cao R., Franciso M, Naya S., Presedo M., Vázquez M., Vilar J.A. and Vilar J.M. (2001). Introducción a la Estadística y sus aplicaciones. . Editorial Pirámide - José Hernández Orallo, M.José Ramírez Quintana, Cèsar Ferri Ramírez. (2004). INTRODUCCIÓN A LA MINERÍA DE DATOS. Editorial Pearson. - Faraway, J.J. (2004). Linear models with R. . Chapman and Hall. - Ugarte L. Militino A. and Arnholt A. (2007). Probability and Statistics with R. CRC Press - Draper, N.R. y Smith, H. (1998). Applied Regression Analysis.. Wiley. Greene, W. - Peña, D. (2002). Regresión y diseño de experimentos. . Alianza Editoria - Venables, W.N. y Ripley, B.D. (2002). Modern applied statistics with S. . Springer - http://www.r-project.org/ (). . - Vikneswaran (2005). An R companion to ?Experimental Design?. URL http://CRAN.R-project.org/doc/contrib/Vikneswaran-ED-companion.pdf. - Gareth J., Witten, D., Hastie, T. and Tibshirani R. (2013). An Introduction to Statistical Learning. Springer
Complementary	- Montgomery, D.C. (2009). Design and Analysis of Experiments. 7th Edition,. J. Wiley and Sons - Box, G.E.P., Hunter, W.G. y Hunter J.S. (2005). Statistics for Experimenters: Design, Innovation, and Discovery. 2nd. Edition, . Wiley, New York

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Other comments
To help achieve a sustained immediate environment and meet the objective of action number 5: "Healthy and sustainable environmental and social teaching and research" of the "Green Campus Ferrol Action Plan":The delivery of the documentary work carried out in this subject:They will be requested in virtual format and/or computer supportIt will be done through Moodle, in digital format without the need to print them.If it is necessary to make them on paper:Plastics shall not be used.Double-sided printing shall be carried out.Recycled paper will be used.Printing of drafts shall be avoided.A sustainable use of resources and the prevention of negative impacts on the natural environment must be made.