UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2022/23
Subject (*)	ESTATÍSTICA		Code	730G04008
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	First	Basic training	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Análise Económica e Administración de EmpresasEconomíaEmpresaMatemáticas			
Coordinador	Garcia del Valle, Alejandro		E-mail	alejandro.garcia.delvalle@udc.es
Lecturers	Crespo Pereira, Diego Garcia del Valle, Alejandro Ríos Prado, Rosa		E-mail	diego.crespo@udc.es alejandro.garcia.delvalle@udc.es rosa.rios@udc.es
Web				
General description	This subject teaches the concepts of Statistics applied to Industrial Engineering			

Study programme competences / results	
Code	Study programme competences / results
A1	FB1 Capacidade para a resolución dos problemas matemáticos que poidan formularse na enxeñaría. Aptitude para aplicar os coñecementos sobre: álxebra lineal; xeometría; xeometría diferencial; cálculo diferencial e integral; ecuacións diferenciais e en derivadas parciais; métodos numéricos; algorítmica numérica; estatística e optimización.
B2	CB2 Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo
B3	CB3 Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitiren xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
B4	CB4 Que os estudantes poidan transmitir información, ideas, problemas e solucións a un público tanto especializado como leigo
B5	CB5 Que os estudantes desenvolvan aquelas habilidades de aprendizaxe necesarias para emprenderen estudos posteriores cun alto grao de autonomía
B6	B3 Ser capaz de concibir, deseñar ou poñer en práctica e adoptar un proceso substancial de investigación con rigor científico para resolver calquera problema formulado, así como de comunicar as súas conclusións ?e os coñecementos e razóns últimas que as sustentan? a un público tanto especializados como leigo dun xeito claro e sen ambigüidades
B7	B5 Ser capaz de realizar unha análise crítica, avaliación e síntese de ideas novas e complexas
C1	C3 Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.
C4	C6 Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.

Learning outcomes			
Learning outcomes	Study programme competences / results		
Be able to solve the mathematical problems of Statistics that can be applied in engineering.	A1	B2 B3 B4 B5 B6 B7	C1 C4

Contents	
Topic	Sub-topic
The following topics develop the contents established in the tab of the Verification Memory that are:	Statistics
Introduction to Statistics	Introduction Random phenomena. Statistical inference. Stages of a statistical investigation. Problems.
2. Exploratory data analysis.	Descriptive statistics. Tabulation of a sample with repetitive data: frequency table. Histogram Cumulative diagram Tabulation of a sample with non-repetitive data: frequency table. Measures of central tendency. Measures of dispersion. Other measures of dispersion. Measures of form. Diagram of boxes and whiskers. Analysis of the stability of the relative frequencies. Problems.
3. Probability.	Sample space. Operations with success. Counting techniques Fundamental properties of the frequencies. Axioms of the probabilities. Probability function. Properties deduced from the axioms. Definition of probability according to Laplace. Probability conditioned. Product theorem Total probability theorem. Bayes theorem. Dependence and independence of events. Problems.
4. Ramdom variables.	Random variable. Discrete random variable: characteristics. Continuous random variable: characteristics. Tchebycheff's theorem. Characteristic function Transformation of random variables. Problems.
5. Discrete random variables and probability distributions.	Introducción. Pruebas de Bernouilli. Distribución binomial. Distribución geométrica. Distribución hipergeométrica. Distribución de Poisson. Aproximación de distribuciones. Problemas.
6. Continous random variables and probability distributions.	Introducción. Distribución uniforme. Distribuciones Erlang y gamma. Distribución exponencial. Distribución de Weibull. Distribución normal. Gráficos de probabilidad. Problemas.
7. Joint probability distributions.	Distribuciones de probabilidad conjuntas. Función de distribución conjunta. Distribuciones marginales. Variable aleatoria bidimensional discreta. Variable aleatoria bidimensional continua. Variables aleatorias independientes. Variable aleatoria n dimensional. Esperanza matemática. Teoremas de adición. Transformación de variables aleatorias. Teorema central de límite. Problemas.
8. Statistical inference.	Statistical sampling. Distributions associated with a sampling process. Distribution of the sample mean. The statistical variance sample. Chi-square distribution of Pearson. Simple random sampling of a normal distribution. Student's t distribution. Student's reason F distribution of Snedecor. Problems.
9. Point estimation of parameters.	Estimation by points. Centered estimators. Consistent estimators Sufficiency. Criterion of Neyman-Fisher. Methods of obtaining estimators. Problems.
10. Statistical intervals for a single sample.	Confidence intervals. Confidence interval for the mean of a normal population with known variance. Confidence interval for the mean of a normal population with unknown variance. Confidence interval for the variance of a normal population. Confidence interval for the proportion of a population. Problems.
11. Test of hypotheses for a single sample.	Contrast of statistical hypothesis. Unilateral and bilateral contrasts. P values in contrast to hypotheses. Connection between hypothesis contrasts and confidence intervals. General procedure for hypothesis contrasts. Test of the mean of a normal population with known variance. Test of the mean of a normal population with unknown variance. Contrast of the variance and standard deviation of a normal distribution. Contrast of the proportion of a population. Contrast of goodness of fit. Contrast with contingency tables. Problems.
12. Regression.	Association between random variables. Regression analysis. Quadratic minimum linear regression. Problems.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A1 B2 B3 B4 B5 B6 B7 C1 C4	25	45	70
Problem solving	A1 B2 B3 B4 B5 B6 B7 C1 C4	20	20	40
ICT practicals	A1 B2 B3 B4 B5 B6 B7 C1 C4	12	18	30
Mixed objective/subjective test	A1 B2 B3 B4 B5 B6 B7 C1 C4	3	6	9
Personalized attention		1	0	1
(*)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	Lectures about the course topics.
Problem solving	Solving exercises and statistical problems encountered in engineering.
ICT practicals	Resolution of practical cases of statistical problems by Excel.
Mixed objective/subjective test	Midterm exam: chapters 1 to 6.

Personalized attention	
Methodologies	Description
ICT practicals Mixed objective/subjective test	The personalized attention will be made in the tutorials.

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**
ICT practicals	A1 B2 B3 B4 B5 B6 B7 C1 C4	Evaluation of case studies solved in small groups.	30
Mixed objective/subjective test	A1 B2 B3 B4 B5 B6 B7 C1 C4	Exams on the topics of the subject.	70

Assessment comments

First opportunity evaluation: a weighted grade will be calculated according to the weights indicated in the Methodologies. There will be two tests: Mixed Test 1: Partial exam with the first topics of the subject with test questions and problem solving. If passed, this test releases the corresponding part in Mixed Test 2. If it fails, it can be recovered by doing the corresponding part in Mixed Test 2. It will be worth 30% of the mark corresponding to Mixed Test (21% of the mark final).Mixed Test 2: Final exam of the course with test questions and problem solving. It will be worth 40% of the grade corresponding to the mixed test (28% of the final grade).Second chance evaluation: the same criteria as for the first chance evaluation will be followed. Advance call: the exam will contain an additional part corresponding to the Practices through ICT. The evaluation will follow the same criteria as for the first opportunity.

Fraudulent performance of tests or assessment activities will automatically result in a fail grade of "0" in the corresponding call, thus invalidating any qualification obtained in all assessment activities.

The "students with recognition of part-time dedication and academic waiver of attendance exemption" will communicate their situation to the professors of the subject at the beginning of the course, as established by the "Rule that regulates the regime of dedication to the study of undergraduate students at the UDC" (Art. 3.b and 4.5) and the "Rules for evaluation, review and complaint of grades for university degree and master's studies (Art. 3 and 8b). Students in this situation will be evaluated on the date approved by the School Board, through an additional test that will consist of solving exercises on the contents of step 3 of the Guide. This test is equivalent to the "Internships through ICT" and has a weight of 30%.

Sources of information	
Basic	- Douglas C. Montgomery, George C. Runger (2011). Applied Statistics and Probability for Engineers. John Wiley - García del Valle, Alejandro; Crespo, Diego (2010). Apuntes de Estadística para Ingenieros. Moodle UDC
Complementary	- Ronald E. Warpole (1999). Probabilidad y Estadística para Ingenieros. Pearson - S. Christian Albright, Wayne Winston, Christopher J. Zappe (1999). Data Analysis & Decision Making with Microsoft Excel. Duxbury

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Industrial Management/730G03024 Simulation of Industrial Processes and Optimization/730G04065
Other comments
There is a very extensive and up-to-date bibliography on Statistics in the library of the Higher Polytechnic School (much of it in English). The notes of the subject will be available in digital format as well as the statements of the proposed cases. A sustainable use of resources must be made to prevent negative impact on the natural environment. For this reason, the delivery of the documentary works carried out in this matter: a) will be requested in virtual format and / or computer support, b) will be carried out in digital format without the need to print them. If it is necessary to make them on paper: a) plastics will not be used, b) double-sided printing will be made, c) recycled paper will be used, d) the printing of drafts will be avoided.

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.