UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: STATISTICS
Type: BASIC
Degree: 345 - UNDERGRADUATE DEGREE PROGRAMME IN CIVIL ENGINEERING
Center: 603 - E.T.S. CIVIL ENGINEERS OF CR
Year: 1
Main language: Spanish
Use of additional languages:
Web site:

Code: 38306
ECTS credits: 6
Academic year: 2022-23
Group(s): 20
Duration: C2
Second language: English
English Friendly: Y
Bilingual: N

Lecturer: **ROSA EVA PRUNEDA GONZALEZ** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
Politecnico 2-D33	MATEMÁTICAS	3292	rosa.pruneda@uclm.es	

2. Pre-Requisites

Previous knowledge: basic mathematical operations(powers, logarithms, fractions), polynomials, matrices, derivation, integration and graphic representation of functions. Basic computing skills.

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

This course provides the necessary skills for analyzing and interpretating data. In many areas of civil engineering the data analysis allows to make decisions in the professional performance. In particular, the contents of this course will be useful in subjects as Techno

4. Degree competences achieved in this course

Course competences

Code	Description
CE01	Students can apply their knowledge in the practical solution of civil engineering problems, with capacity for the analysis and definition of the problem, the proposal of alternatives and their critical evaluation, choosing the optimal solution with technical arguments and with capacity of defense against third parties.
CE02	Students have the ability to broaden their knowledge and solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study. Self-study ability, to undertake further studies with a high degree of autonomy
CE04	Students have the 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 and partial derivative equations; numerical methods; numerical algorithms; statistics and optimization.
CE06	Students have a basic knowledge of the use and programming of computers, operating systems, databases and software with engineering application.
CG01	Students achieve general knowledge of Information and Communication Technologies (ICT).

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Students know and interpret the fundamental measures of descriptive statistics, approximate data through regression adjustments, know the fundamentals of probability, estimate the parameters of statistical models, build confidence intervals, contrast hypotheses and make decisions.

Students are familiar with computer use: operative systems, databases, programming languages, and software applied to civil engineering.

Students are able to express correctly both orally and in writing and, in particular, they can use the language of mathematics as a way of expressing accurately the quantities and operations in civil engineering. Students get used to teamwork and behave respectfully.

Students use mathematical and computer tools to pose and solve civil engineering problems.

Students learn the most important approximations for numerical method resolution, use some statistical, data processing, mathematical calculation and visualization software packages at user level, develop algorithms and program using a high-level programming language, visualize functions, geometric shapes and data, design experiments, analyze data, and interpret results.

Additional outcomes

Students realize that uncertaint is everywhere and engineers have to deal whit it. They develope skills analyzing the information contained in a data set by means of frequency tables, graphs and statistics. They know the most common models of discrete and continuous random variables and their relationship with engineering problems. They get the most common methods, including probability plots, for the estimation of extreme values ¿¿in engineering designs. They know return period concept for measuring engineering risk and make decisions based on probability, applying the usual estimation methods; contrast of hypothesis, regression, etc.

6. Units / Contents

Unit 1: DESCRIPTIVE STATISTICS. Frequency tables. Graphics. Statistics.

Unit 2: PROBABILITY. Definition. Properties. Conditional probability. Total probability and Bayes Theorems.

Unit 3: RANDOM VARIABLES. One-dimensional variables: Definition. Discrete variables. Probability function. Continuous variables. Density function. Mixed variables. Probability-density function. Distribution function. Two-dimensional variables: Definition. Density, probability and distribution function for two-dimensional variables.

Unit 4: DISCRETE VARIABLES. One-dimensional variables: Bernouilli, binomial, negative binomial, pascal or geometric, hypergeometric, poisson. Two-dimensional variables: Multinomial.

Unit 5: CONTINUOUS VARIABLES. One-dimensional variables: Uniform, exponential, gamma, beta, normal, log-normal.

Unit 6: EXTREME DISTRIBUTIONS. Order Statistics. Distribution of an order statistic. Maximum distribution. Minimum distribution. Extreme distributions. Return period. Critical design values.

Unit 7: PROBABILITY PLOTS. Empirical function. Fundamentals of probability plots. Exceedance probability. Return period.

Unit 8: ESTIMATION. Punctual and by intervals. Estimation of proportions. Estimation of means. Estimation of variances.

Unit 9: HYPOTHESIS CONTRASTS. Fundamentals of the hypothesis contrast. Power of a contrast. P-value. Contrasts of proportions, means and variances. Goodness of fit tests.

Unit 10: REGRESSION. Linear regression model. Hypothesis of the model. Matrix form of a regression problem. Analysis of variance. Hypothesis contrasts in the regression models.

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	CE01 CE02 CE04 CE06 CG01	1	25	N	-	
Class Attendance (practical) [ON-SITE]	Problem solving and exercises	CE01 CE02 CE04 CE06 CG01	1.08	27	N	-	
Final test [ON-SITE]	Assessment tests	CE01 CE02 CE04 CE06 CG01	0.16	4	Y	Y	Recoverable
Study and Exam Preparation [OFF-SITE]	Self-study	CE01 CE02 CE04 CE06 CG01	3.24	81	N	-	
Progress test [ON-SITE]	Combination of methods	CE01 CE02 CE04 CE06 CG01	0.16	4	Y	N	
		Total:	**5.64**	**141**			
		Total credits of in-class work: 2.4					**Total class time hours: 60**
		Total credits of out of class work: 3.24					**Total hours of out of class work: 81**

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
Progress Tests	40.00%	0.00%	Progress tests and on-line activities.
Final test	60.00%	100.00%	Final test
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:

EXAM (60%) + PROJECTS AND TESTS (40%)
You need 5 or more out of 10 to pass.

During the course, 2 partial exams will be carried out. Minimum grade of 4 out of 10 is required in each one of them. The first partial includes the topics 1 to 5 inclusive, the second 6 to 10 inclusive. The average of the two partial exam's score is the EXAM score. In addition, various tests and activities will be carried out, the average of them will be the PROJECTS AND TESTS score.

Partial exams and / or PROJECTS AND TESTS scores (4 out of 10 minimum) are keept to the Final and Retake.

The ordinary call will consist of an exam (60%) with two partials (minimum score 4 out 10 each one and final score is the average) and one practical computer test (40%).
Grades are not saved from previous courses.

Non-continuous evaluation:

The student will have to do a global exam including all the course and competence contents. To pass the course, the student must obtain at least a 5 out of 10 score, which will constitute 100% of his/her grade.

Unless stated otherwise, continuous evaluation criteria will be applied to all students.

Anyone choosing non-continuous assessment must notify it to the lecturer within the class period of the subject. The option is only available if the student's participation in evaluation activities (from the continuous assessment) has not reached 50% of the total evaluation for the subject.

For the retake exam, the assessment type used for the final exam will remain valid.

Grades are not saved from previous courses.

Specifications for the resit/retake exam:

Same criteria that the final exam. All the exam and projects and tests are recoverable.

Specifications for the second resit / retake exam:

The student will have to do a global exam that will include all the course and competences content. To pass the course, the student must obtain at least a 5 out of 10 score, which will constitute 100% of his/her grade.
Grades are not saved from previous courses.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents	
Hours	**hours**
Final test [PRESENCIAL][Assessment tests]	4
Study and Exam Preparation [AUTÓNOMA][Self-study]	75
Unit 1 (de 10): DESCRIPTIVE STATISTICS. Frequency tables. Graphics. Statistics.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	2
Unit 2 (de 10): PROBABILITY. Definition. Properties. Conditional probability. Total probability and Bayes Theorems.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	3
Unit 3 (de 10): RANDOM VARIABLES. One-dimensional variables: Definition. Discrete variables. Probability function. Continuous variables. Density function. Mixed variables. Probability-density function. Distribution function. Two-dimensional variables: Definition. Density, probability and distribution function for two-dimensional variables.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	2
Unit 4 (de 10): DISCRETE VARIABLES. One-dimensional variables: Bernouilli, binomial, negative binomial, pascal or geometric, hypergeometric, poisson. Two-dimensional variables: Multinomial.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	3
Unit 5 (de 10): CONTINUOUS VARIABLES. One-dimensional variables: Uniform, exponential, gamma, beta, normal, log-normal.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	2
Unit 6 (de 10): EXTREME DISTRIBUTIONS. Order Statistics. Distribution of an order statistic. Maximum distribution. Minimum distribution. Extreme distributions. Return period. Critical design values.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	2
Unit 7 (de 10): PROBABILITY PLOTS. Empirical function. Fundamentals of probability plots. Exceedance probability. Return period.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	3
Unit 8 (de 10): ESTIMATION. Punctual and by intervals. Estimation of proportions. Estimation of means. Estimation of variances.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	2
Unit 9 (de 10): HYPOTHESIS CONTRASTS. Fundamentals of the hypothesis contrast. Power of a contrast. P-value. Contrasts of proportions, means and variances. Goodness of fit tests.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	2
Unit 10 (de 10): REGRESSION. Linear regression model. Hypothesis of the model. Matrix form of a regression problem. Analysis of variance. Hypothesis contrasts in the regression models.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	2
Global activity	
Activities	**hours**
Final test [PRESENCIAL][Assessment tests]	4
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	23
Study and Exam Preparation [AUTÓNOMA][Self-study]	75
Class Attendance (theory) [PRESENCIAL][Lectures]	23
Total horas:	125

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Castillo, Enrique	Introducción a la Estadística Aplicada con Mathematica	[s.n.]		84-604-0299-1	1991	
Castillo, Enrique; Pruneda, Rosa Eva	Introducción a la Estadística Aplicada	Moralea		84-923157-4-1	2001	
Peña, Daniel	Fundamentos de Estadística	Alianza Editorial		978-84-206-8380-5	2008	
Spiegel, Murray R.	Estadística	McGraw-Hill		978-970-10-6887-8	2009	
Walpole, Ronald E.	Probability and Statistics for Engineers and Scientists	Pearson Educación		978-970-26-0936-0	2007	
Devore, Jay L.	Probabilidad y estadística para ingeniería y ciencias /	CENGAGE Learning,		978-607-522-828-0	2016	