

# UNIVERSIDAD DE CASTILLA - LA MANCHA **GUÍA DOCENTE**

#### 1. General information

Course: STATISTICS AND COMPUTATIONAL METHODS

Type: BASIC Degree: 409 - CHEMISTRY

Center: 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY Year: 1

Main language: Spanish

Use of additional languages:

ECTS credits: 6 Academic year: 2023-24 Group(s): 23 20 Duration: C2 language: English English Friendly: Y

Lecturer: ELENA GAJATE PANIAGUA - Group(s): 23 20							
Building/Office	Department	Phone number	Email	Office hours			
340 Margarita Salas	MATEMÁTICAS		Elena.Gajate@uclm.es	Available in the Virtual Secretary's Office, section My Teachers (https://secretariavirtual.apps.uclm.es)			

To achieve the learning objectives of the subject is required basic knowledge and skills in elementary mathematical operations (powers, logarithms, exponentials, fractions, ...), basic knowledge of derivation and integration of real functions of a real variable, and fun

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

In any branch of Chemistry, Statistics is an essential tool for data organization, data analysis and interpretation of results in any chemical, academic and professional experimental activity. Likewise, the mathematical concepts studied in the subject of Statistics provid

# 4. Degree competences achieved in this course

Description

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.

Develop the ability to relate to each other the different specialties of Chemistry, as well as this one with other disciplines (interdisciplinary character) CB01

E17

Know the principles and theories of Chemistry, as well as the methodologies and applications characteristic of analytical chemistry, physical chemistry, inorganic chemistry and organic chemistry, understanding the physical and mathematical bases that require G01

Domain of Information and Communication Technologies (ICT)

T03 Proper oral and written communication

Organization and planning capacity

T07 Ability to work as a team and, where appropriate, exercise leadership functions, fostering the entrepreneurial character

T08

### 5. Objectives or Learning Outc

# Course learning outc

#### Not established

T02

### Additional outcomes

The student will acquire the statistical knowledge necessary for the approach and resolution of certain problems characteristic of Chemistry. In particular, they will acquire knowledge of the fundamental parameters of descriptive statistics, how to approximate two-dimensional data by fitting functions, how to recognise different random variables and handle their tables, test hypotheses and make decisions. In addition, the student will learn about different types of experimental design and quality control needed in the laboratory and in industry. Students will use R statistical software at user level.

# 6. Units / Contents

### Unit 1: Unidimensional descriptive statistics

Unit 1.1 Frequency distributions

Unit 1.2 Graphic representation

Unit 1.3 Measures of central tendency
Unit 1.4 Measures of variation

Unit 1.5 Introduction to the software R

Unit 2: Bidimensional descriptive statistics

Unit 2.1 Joint variable distribution

Unit 2.2 Simple linear regression
Unit 2.3 Correlation and simple regression analysis

Unit 2.4 ANOVA - Analysis of Variance

Unit 2.5 Nonlinear regression models Unit 2.6 Applications with R

# Unit 3: Introduction to Probability

Unit 3.1 Events. Sample space. Probability of an event.

Unit 3.2 Conditional probability and independence

Unit 3.3 Bayes' Theorem

# Unit 4: Random variables and probability distributions

Unit 4.1 Notion of random variable
Unit 4.2 Functions of Random Variables

Unit 4.3 Mean and variance of a random variable. Chebyshev's theorem

Unit 4.4 Discrete probability distributions

Unit 4.5 Continuous probability distributions

Unit 5: Confidence Intervals
Unit 5.1 Mean and variance of a sample

Unit 5.2 Different estimating errors
Unit 5.3 One sample estimating confidence intervals

Unit 5.4 Two sample estimating confidence intervals

Unit 5.5 Applications with R

# Unit 6: Hypothesis Testing

Unit 6.1 Testing a statistical hypothesis
Unit 6.2 Unilateral and bilateral hypothesis testing

Unit 6.3 Hypothesis testing for one population

Unit 6.4 Hypothesis testing for two populations
Unit 6.5 Nonparametric hypothesis testing

# Unit 6.6 Applications with R Unit 7: Advanced analysis of variance techn

Unit 7.1 One way analysis of variance

Unit 7.2 Two-factor analysis of variance

Unit 7.3 Applications with R

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	CB01 E17 G01 T02 T03 T05 T07 T08	1.36	34	N	-			
Problem solving and/or case studies [ON-SITE]	Guided or supervised work	CB01 E17 G01 T02 T03 T05 T07 T08	0.44	11	N	-			
Computer room practice [ON-SITE]	Practical or hands-on activities	CB01 E17 G01 T02 T03 T05 T07 T08	0.24	6	Y	Y			
Project or Topic Presentations [ON-SITE]	Group Work	CB01 E17 G01 T02 T03 T05 T07 T08	0.04	1	Υ	Y			
Progress test [ON-SITE]	Assessment tests	CB01 E17 G01 T02 T03 T05 T07 T08	0.04	1	Υ	N			
Final test [ON-SITE]	Assessment tests	CB01 E17 G01 T02 T03 T05 T07 T08	0.12	3	Υ	Y			
Study and Exam Preparation [OFF-SITE]	Self-study	CB01 E17 G01 T02 T03 T05 T07 T08	3.6	90	N	-			
Mid-term test [ON-SITE]	Assessment tests		0.16	4	Υ	N			
Total:									
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)

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Test	70.00%	80.00%	Performance of two partial exams based on individual problem solving. The correctness of the approach to the problems and the application of the resolution methods are evaluated. Errors in concepts and basic mathematical operations are penalized. Partial exams passed with a grade higher or equal to 4.0 imply the release of the corresponding subject for the final exam.
Projects	10.00%	10.00%	Written presentation of a team work based on the collection and analysis of data applying the statistical methods taught in the course. The quality and originality of the written report presented will be evaluated.
Progress Tests	10.00%	0.00%	Performance of a progress test based on individual problem solving. The correctness of the approach to the problems and the application of the resolution methods are evaluated. Errors in concept and in basic mathematical operations imply penalties.
Assessment of activities done in the computer labs	10.00%		Performance of a computer test consisting of solving several problems with the statistical software R. The approach, the correctness and the methods of solving the proposed problems are evaluated.
Total:	100.00%	100.00%	

tota: 100.00% | 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:

- Continuous assessment:
  The final grade of the continuous evaluation is obtained as the sum of:
   10% activities carried out in the computer classroom;
   10% team work presented in writing and/or orally;
   10% team progress test;
   70% average of the two partial exams passed (grade higher or equal to 4.0).

To pass the subject by continuous evaluation it is necessary to have obtained at least a 4 in each of the two midterm exams and that the final grade, in accordance with the above, is equal to or higher than 5.0.

# Non-continuous evaluation:

Non-continuous evaluation:

The final grade is obtained as the sum of:

- 10% of the average mark of the activities carried out with computers;

- 10% of the grade for the oral and written presentation of a team work;

- 80% of the grade of the final exam and/or midderm exams passed (with a grade higher or equal to 4.0).

The course will be passed if in the final exam the student obtains a grade equal or higher than 4 and the final grade, in accordance with the above, is equal or higher than 5.0.

Specifications for the resit/retake exam: final exam is taken with the whole subject or with the subject matter of the failed midterm.

The final grade is obtained as the sum of:

- 10% of the average grade of the activities performed in the computer classroom;
   10% of the grade of the oral and written presentation of a team work;
   80% of the grade of the final exam passed (grade higher or equal to 4.0).

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