



1. General information

Course: STATISTICS AND COMPUTATIONAL METHODS
 Type: BASIC
 Degree: 409 - CHEMISTRY
 Center: 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY
 Year: 1

Code: 57306

ECTS credits: 6
 Academic year: 2023-24

Group(s): 23 20

Duration: C2

Second language: English

English Friendly: Y

Bilingual: N

Main language: Spanish

Use of additional languages:

Web site:

Lecturer: ELENA GAJATE PANIAGUA - Group(s): 23 20				
Building/Office	Department	Phone number	Email	Office hours
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2. Pre-Requisites

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

Course competences

Code	Description
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.
E17	Develop the ability to relate to each other the different specialties of Chemistry, as well as this one with other disciplines (interdisciplinary character)
G01	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
T02	Domain of Information and Communication Technologies (ICT)
T03	Proper oral and written communication
T05	Organization and planning capacity
T07	Ability to work as a team and, where appropriate, exercise leadership functions, fostering the entrepreneurial character
T08	Skills in interpersonal relationships

5. Objectives or Learning Outcomes

Course learning outcomes

Not established.

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 techniques

- 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	Y	Y	
Progress test [ON-SITE]	Assessment tests	CB01 E17 G01 T02 T03 T05 T07 T08	0.04	1	Y	N	
Final test [ON-SITE]	Assessment tests	CB01 E17 G01 T02 T03 T05 T07 T08	0.12	3	Y	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	Y	N	
Total:			6	150			
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).

8. Evaluation criteria and Grading System

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%	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%	

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:

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% of the 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:

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 midterm 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).

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	hours
Project or Topic Presentations [PRESENCIAL][Group Work]	1
Progress test [PRESENCIAL][Assessment tests]	1
Final test [PRESENCIAL][Assessment tests]	3
Unit 1 (de 7): Unidimensional descriptive statistics	
Activities	
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Guided or supervised work]	1
Computer room practice [PRESENCIAL][Practical or hands-on activities]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	8
Mid-term test [PRESENCIAL][Assessment tests]	.6
Unit 2 (de 7): Bidimensional descriptive statistics	
Activities	
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Guided or supervised work]	2
Computer room practice [PRESENCIAL][Practical or hands-on activities]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Mid-term test [PRESENCIAL][Assessment tests]	.5
Unit 3 (de 7): Introduction to Probability	
Activities	
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Problem solving and/or case studies [PRESENCIAL][Guided or supervised work]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	14
Mid-term test [PRESENCIAL][Assessment tests]	.6
Unit 4 (de 7): Random variables and probability distributions	
Activities	
Class Attendance (theory) [PRESENCIAL][Lectures]	7
Problem solving and/or case studies [PRESENCIAL][Guided or supervised work]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	16
Mid-term test [PRESENCIAL][Assessment tests]	.6
Unit 5 (de 7): Confidence Intervals	
Activities	
Class Attendance (theory) [PRESENCIAL][Lectures]	6
Problem solving and/or case studies [PRESENCIAL][Guided or supervised work]	2
Computer room practice [PRESENCIAL][Practical or hands-on activities]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	15
Mid-term test [PRESENCIAL][Assessment tests]	.6
Unit 6 (de 7): Hypothesis Testing	
Activities	
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Guided or supervised work]	1
Computer room practice [PRESENCIAL][Practical or hands-on activities]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	15
Mid-term test [PRESENCIAL][Assessment tests]	.5
Unit 7 (de 7): Advanced analysis of variance techniques	
Activities	
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Computer room practice [PRESENCIAL][Practical or hands-on activities]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	12
Mid-term test [PRESENCIAL][Assessment tests]	.6
Global activity	
Activities	
Final test [PRESENCIAL][Assessment tests]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Class Attendance (theory) [PRESENCIAL][Lectures]	34
Problem solving and/or case studies [PRESENCIAL][Guided or supervised work]	11
Computer room practice [PRESENCIAL][Practical or hands-on activities]	6
Project or Topic Presentations [PRESENCIAL][Group Work]	1
Progress test [PRESENCIAL][Assessment tests]	1
Mid-term test [PRESENCIAL][Assessment tests]	4
Total horas: 150	

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Canavos, George C.	Probabilidad y estadística : aplicaciones y métodos	McGraw-Hill		968-451-856-0	1988	Libro de teoría con diversos problemas resueltos.
Devore, Jay L.	Probabilidad y estadística para ingeniería y ciencias	Cengage Learning		978-607-481-619-8	2012	
Horra Navarro, Julián de la	Estadística aplicada	Díaz de Santos		978-84-7978-554-3	2009	Libro de teoría con diversos problemas resueltos.
López Fidalgo, Jesús	El azar no existe /	Electolibris,		978-84-943060-1-3	2015	
Mendenhall, William	Estadística matemática con aplicaciones	Grupo Editorial Iberoamérica		968-7270-17-9	1986	Libro con diversas aplicaciones y problemas resueltos.

Miller, J. C.	Estadística para química analítica http://www.r-project.org	Addison-Wesley Iberoamericana	0-201-60140-0	1993	Libro de aplicación de la Estadística a la Química con diversos problemas Página Web donde se puede descargar gratuitamente el software libre R así como documentación sobre su manejo.
Mansfield, Edwin	Statistics for business and economics: problems, exercises,	W. W. Norton & Company	0-393-95571-0	1987	
Larsen, Richard J.	An introduction to Mathematical Statistics and Its Applications	Prentice-Hall	0-13-487174-X	1986	
Ross, Sheldon M.	A first course in probability	Prentice-Hall	0-13-896523-4	1998	
Mendenhall, William	Introduction to probability and statistics	PWS-KENT	0-534-98264-6	1991	