

**1. General information****Course:** MATHEMATICS**Type:** BASIC**Degree:** 383 - UNDERGRADUATE DEGREE PROGRAMME IN FOOD SCIENCE AND TECHNOLOGY**Center:** 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY**Year:** 1**Main language:** Spanish**Use of additional languages:****Web site:****Code:** 58301**ECTS credits:** 9**Academic year:** 2023-24**Group(s):** 22**Duration:** AN**Second language:** English**English Friendly:** Y**Bilingual:** N**Lecturer:** FRANCISCO PLA MARTOS - Group(s): 22

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**2. Pre-Requisites**

To achieve the learning objectives of the subject, knowledge and skills that are supposed to be guaranteed in the training prior to accessing the University are required. In particular, basic knowledge of geometry, algebra and trigonometry, elementary mathematical operations (powers, logarithms, exponentials, fractions ...), basic knowledge of derivation and integration of real functions of real variables and fundamentals of graphical representation of functions are necessary.

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

As in all scientific disciplines, in Food Science and Technology, Mathematics and Statistics are a basic tool. Mathematics is present in the approach and development of all experimental, academic and professional activities in Food Science and Technology.

The mathematical concepts studied in the subject of Mathematics and Statistics provide an essential tool and constitute a precise language that is later used by most of the basic subjects and other subjects.

Another important aspect of the subject of Mathematics and Statistics is that it is a subject that helps to enhance the capacity for abstraction, rigor, analysis and synthesis that are characteristic of mathematics and necessary for any other scientific discipline.

**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.
E01	To acquire basic knowledge in chemistry, mathematics, physics to allow the study of the nature of foods, causes of their alteration and fundamentals of their production processes
G02	To possess a correct oral and written communication. To transmit information, ideas, problems and solutions to a both specialized and not specialized public.
G04	To develop the necessary skills of learning to undertake later studies with a high degree of autonomy.
G06	To dominate the Technologies of the Information and the Communication (TIC) to user's level, which allows to work in virtual spaces, Internet, electronic databases, as well as with common software packages (e.g. Microsoft Office).
G08	To know the principles and the theories of Basic Science as well as the methodologies and applications of the chemistry, physics, biology and mathematics that are necessary to acquire the specific knowledge of the Degree.

**5. Objectives or Learning Outcomes****Course learning outcomes****Description**

To know derivate, integrate and plot one and several variables functions, as well as the meaning of the derivate and the integral

To know how to calculate the principal parameters of the descriptive statistic

To know how to approximate functions and data by means of developments in power and Fourier series

To know how to model food technology processes through differential equations, solve them and interpret results

To know how to use the language of Mathematics

To know the theory about matrices and know how to implement the corresponding calculations

**Additional outcomes**

To know the main approaches to solving using numerical methods and use some statistical software packages at the user level.

To get used to teamwork, express oneself orally and in writing, and behave respectfully.

**6. Units / Contents****Unit 1: Algebra fundamentals****Unit 1.1** Matrices and determinants

- Unit 1.2** Linear equations systems
- Unit 1.3** Operations with matrices and determinants and solution of systems of linear equations with Matlab
- Unit 2: Differential and integral calculation of one variable**
- Unit 2.1** Limits and continuity
- Unit 2.2** Derivatives
- Unit 2.3** Taylor polynomial. Functional approximation
- Unit 2.4** Optimization. Growth. Extremes. Convexity
- Unit 2.5** Indefinite and definite integrals
- Unit 2.6** Improper integrals
- Unit 2.7** Graphical representation, derivation, integration and approximation of functions with Matlab
- Unit 3: Differential and integral calculation of several variables**
- Unit 3.1** Multi-variable functions
- Unit 3.2** Limits and continuity
- Unit 3.3** Partial derivatives. Gradient
- Unit 3.4** Optimization. Extremes. Second derivatives criterion
- Unit 3.5** Introduction to double integrals
- Unit 3.6** Graphical representation, differentiation, integration and optimization in several variables with Matlab
- Unit 4: Introduction to differential equations**
- Unit 4.1** Exact solution of first-order ordinary differential equations
- Unit 5: One-dimensional descriptive statistics**
- Unit 5.1** Frequency distribution
- Unit 5.2** Graphic representations
- Unit 5.3** Measures of centralization and dispersion
- Unit 5.4** Practice with computer. Introduction to scientific statistical software R
- Unit 6: Two-dimensional descriptive statistics**
- Unit 6.1** Distribution and joint representation of two variables
- Unit 6.2** Relation between quantitative variables
- Unit 6.3** Linear regression and prediction
- Unit 6.4** Regression models and regression ANOVA table
- Unit 6.5** Practice with a computer. Scientific and technological applications with R
- Unit 7: Introduction to probability**
- Unit 7.1** Experiments and random events. Definitions
- Unit 7.2** Conditional probability and independence of events
- Unit 7.3** Fundamental theorems of probability
- Unit 8: Random variables and probability distributions**
- Unit 8.1** Definitions
- Unit 8.2** Some discrete and continuous random variable distributions
- Unit 9: Inference. Estimation and hypothesis contrast**
- Unit 9.1** Sampling. Point estimation
- Unit 9.2** Confidence interval estimation
- Unit 9.3** Parametric tests for one and two samples
- Unit 9.4** Practice with computer. Introduction to scientific statistical software R
- Unit 10: Introduction to Experiment Design: One factor ANOVA**
- Unit 10.1** 1-factor ANOVA
- Unit 10.2** Practice with computer. Introduction to scientific statistical software 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 E01 G02 G04 G06 G08	1.9	47.5	Y	N	Face-to-face teaching, teaching theoretical classes and solving exercises.
Workshops or seminars [ON-SITE]	Problem solving and exercises	CB01 E01 G02 G04 G06 G08	0.9	22.5	Y	Y	Tutorized work of solving problems in class.
Computer room practice [ON-SITE]	Practical or hands-on activities	CB01 E01 G02 G04 G06	0.4	10	Y	Y	Tutored problem solving work using computational techniques in class. The objective of these practices is for the student to carry out a Matlab exercise and prepare a statistical work outside of class using R.
Problem solving and/or case studies [ON-SITE]	Group tutoring sessions	CB01 E01 G02 G04 G06	0.1	2.5	Y	Y	It will consist of doing exercises in class and consulting doubts for an hour in class. Work done in class will be taken into account.
Mid-term test [ON-SITE]	Assessment tests	E01 G02 G04 G06	0.16	4	Y	Y	There is a two-hour Part I midterm exam during the course and a second two-hour Part II midterm exam in the final exam. These partials consist of solving a series of proposed exercises related to each part. Part I: Algebra, Calculus and Equations. Part II: Statistics. Part I: Algebra, Calculus and Equations.

							Part II: Statistics.
Final test [ON-SITE]	Assessment tests	E01 G02 G04 G06	0.14	3.5	Y	N	A final exam with all the subject (or only the partial of Part II if the first one was passed) consisting of the resolution of a series of exercises of the entire syllabus (or of the part not passed).
Study and Exam Preparation [OFF-SITE]	Self-study	E01 G02 G04 G06 G08	5.4	135	N	-	Individual study and preparation of evaluation tests.
<b>Total:</b>			<b>9</b>	<b>225</b>			
<b>Total credits of in-class work: 3.6</b>			<b>Total class time hours: 90</b>				
<b>Total credits of out of class work: 5.4</b>			<b>Total hours of out of class work: 135</b>				

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
Projects	15.00%	15.00%	- In the case of continuous evaluation: a team work of the Statistics part will be presented, also using the free statistical software, R. - In the case of Non-Continuous evaluation: an individual work of the Statistics part will be presented using R. Is evaluated: Presentation of the work and correction of the solution and resolution method.
Progress Tests	15.00%	15.00%	- In the case of Continuous evaluation: Troubleshooting and practical cases and exercise with the Matlab program. - In the case of Non-Continuous evaluation: the problems of the progress test and the Matlab exercise will be included in the final exam of the ordinary call. Is evaluated: 1. Correction of the problem statement. 2. Correction of the solution. 3. Correction of written expression. Concept errors and errors in basic mathematical operations will imply penalties.
Test	70.00%	70.00%	- Continuous assessment: Partial/final exams. Is evaluated: 1. Correction of the problem statement. 2. Correction of the solution. 3. Correction of written expression. Concept errors and errors in basic mathematical operations will imply penalties. The partial passed during the course will mean the release of the corresponding part for the final exam.  A minimum of 4/10 will be required in Parts I  - Non-Continuous Evaluation: Final exam. Is evaluated: 1. Correction of the problem statement. 2. Correction of the solution. 3. Correction of written expression. Concept errors and errors in basic mathematical operations will imply penalties.
<b>Total:</b>	<b>100.00%</b>	<b>100.00%</b>	

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:

1. An exam is carried out with all the subject for students who have not passed the first part.

The final grade of these students will be: 70% of the final exam grade + 15% of the progress tests and the Matlab exercise + 15% of the grade of the work in which the R statistical software has been used.

2. A partial exam of Part II is given to students who have passed part of Part I.

The final mark of these students will be: 70% of the average mark of the partial exams + 15% of the progress tests and the Matlab exercise + 15% of the mark of the work in which the statistical software R has been used.

To pass the subject, it will be required that the final average grade, taking into account the description 70%+15%+15%, must be equal to or greater than 5/10. A minimum of 4/10 will be required in Parts I and II

##### Examination evaluation criteria:

1. Correction of the problem statement.
2. Correction of the solution.
3. Correction of written expression.

Concept errors and errors in basic mathematical operations will imply penalties.

**Non-continuous evaluation:**

The student has to indicate at the beginning of the course if he wants the non-continuous evaluation and it has to be justified

There is a final exam with all the material and a computer practice exam.

The final mark of these students will be: 85% of the mark of the final exam in which a Matlab exercise and progress test will be carried out + 15% of the individual work using R.

To pass the subject, it will be required that the final average grade, taking into account the description 90% + 10%, must be equal to or greater than 5/10.

Examination evaluation criteria:

1. Correction of the problem statement.
2. Correction of the solution.
3. Correction of written expression.

Concept errors and errors in basic mathematical operations will imply penalties.

**Specifications for the resit/retake exam:**

1. An exam is carried out with all the subject for students who have not passed any part of the subject in the ordinary call.

The final mark of these students will be: 85% of the final exam mark + 15% of the work mark using R.

2. A partial exam is carried out for students who have not passed said partial exam in the ordinary call.

The final mark of these students will be: 85% of the average mark of the partial exams + 15% of the work using R.

To pass the subject, it will be required that the final average grade, taking into account the description 85% + 15%, must be equal to or greater than 5/10. A minimum of 4/10 will be required in Parts I and II

Examination evaluation criteria:

1. Correction of the problem statement.
2. Correction of the solution.
3. Correction of written expression.

Concept errors and errors in basic mathematical operations will imply penalties.

**Specifications for the second resit / retake exam:**

A final exam is carried out with all the subject for students who have not passed the ordinary exam.

The final mark of these students will be: 85% of the final exam mark + 15% of the work mark using R.

To pass the subject, it will be required that the final average grade, taking into account the description 85% + 15%, must be equal to or greater than 5/10.

Examination evaluation criteria:

1. Correction of the problem statement.
2. Correction of the solution.
3. Correction of written expression.

Concept errors and errors in basic mathematical operations will imply penalties.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Mid-term test [PRESENCIAL][Assessment tests]	4
Final test [PRESENCIAL][Assessment tests]	3
Unit 1 (de 10): Algebra fundamentals	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	12
Unit 2 (de 10): Differential and integral calculation of one variable	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	6
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	2
Computer room practice [PRESENCIAL][Practical or hands-on activities]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	12
Unit 3 (de 10): Differential and integral calculation of several variables	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	9
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	5
Computer room practice [PRESENCIAL][Practical or hands-on activities]	1
Problem solving and/or case studies [PRESENCIAL][Group tutoring sessions]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	17
Unit 4 (de 10): Introduction to differential equations	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Unit 5 (de 10): One-dimensional descriptive statistics	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1
Computer room practice [PRESENCIAL][Practical or hands-on activities]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	12

<b>Unit 6 (de 10): Two-dimensional descriptive statistics</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1
Computer room practice [PRESENCIAL][Practical or hands-on activities]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	14
<b>Unit 7 (de 10): Introduction to probability</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	6
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	4
Study and Exam Preparation [AUTÓNOMA][Self-study]	13
<b>Unit 8 (de 10): Random variables and probability distributions</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	3
Problem solving and/or case studies [PRESENCIAL][Group tutoring sessions]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	15
<b>Unit 9 (de 10): Inference. Estimation and hypothesis contrast</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	6
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	3
Computer room practice [PRESENCIAL][Practical or hands-on activities]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	22
<b>Unit 10 (de 10): Introduction to Experiment Design: One factor ANOVA</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	2
Computer room practice [PRESENCIAL][Practical or hands-on activities]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	8
<b>Global activity</b>	
<b>Activities</b>	<b>hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	47
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	25
Computer room practice [PRESENCIAL][Practical or hands-on activities]	9
Problem solving and/or case studies [PRESENCIAL][Group tutoring sessions]	2
Mid-term test [PRESENCIAL][Assessment tests]	4
Final test [PRESENCIAL][Assessment tests]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	135
<b>Total horas: 225</b>	

<b>10. Bibliography and Sources</b>						
<b>Author(s)</b>	<b>Title/Link</b>	<b>Publishing house</b>	<b>Citv</b>	<b>ISBN</b>	<b>Year</b>	<b>Description</b>
Profesorado del Grado en Ciencia y Tecnología de los Alimentos	Actividades Prácticas del Grado en Ciencia y Tecnología de los Alimentos		Ciudad Real	978-84-939630-5-7	2014	Actividades prácticas del Grado en Ciencia y Tecnología de los Alimentos que están desarrolladas por cursos y asignaturas. La asignatura de Matemáticas y Estadística está en el capítulo 2: Prácticas 1ª, páginas 67-128 y autores Hélica Pereira y Francisco Pla. En este capítulo se describe las prácticas de la asignatura de Matemáticas y Estadística usando Matlab y SPSS y descripciones teóricas de los resultados.
Zill, Dennis G.	Ecuaciones diferenciales con aplicaciones  <a href="http://www.gnu.org/software/octave/">http://www.gnu.org/software/octave/</a>  <a href="http://www.gnu.org/software/octave/">http://www.gnu.org/software/octave/</a>	Iberoamérica		968-7270-45-4	1988	Libro completo: con teoría, problemas resueltos, problemas propuestos y aplicaciones Página web donde se encuentran los programas y documentación del software libre octave.  Página web donde se

	<a href="http://www.r-project.org/">http://www.r-project.org/</a>					encuentran los programas y documentación del software libre R
	<a href="http://www.r-project.org/">http://www.r-project.org/</a>					
García, A. y otros	Cálculo I y II	CLAGSA	Madrid		1994	Libro completo: teoría, problemas resueltos, propuestos y aplicaciones. Con esquemas teóricos.
C.Canavos, George	Probabilidad y Estadística. Aplicaciones y Métodos	MC Graw Hill				Libro de teoría y problemas con aplicaciones. Gran variedad de ejemplos y de ejercicios resueltos muy bien explicados Libro práctico de SPSS: comandos, ejemplos y ejercicios, aplicaciones. Muy buena descripción de los comandos. Se pueden mirar versiones posteriores de SPSS
Camacho Rosales, Juan	Estadística con SPSS para Windows. Versión 11	Ra-Ma			2002	Libro completo: con teoría, problemas resueltos, problemas propuestos y aplicaciones
García J.	Álgebra lineal: sus aplicaciones en Economía, Ingeniería y otras Ciencias	Delta Publicaciones			2006	Es un manual de MATLAB muy pedagógico con múltiples ejemplos aplicados
Herrero, Henar	Informática aplicada a las ciencias y a la ingeniería con Ma	E. T. S. Ingenieros Industriales Librería-Pap	Ciudad Real	84-699-3109-1	2009	Estadística aplicada básica.
Horra Navarro, Julián de la	Estadística aplicada	Díaz de Santos	Madrid	84-7978-225-0	1995	Libro completo: con teoría, problemas resueltos, problemas propuestos y aplicaciones
Lay, David C.	Algebra lineal y sus aplicaciones	Pearson		978-970-26-0906-3	2007	