UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: MATHEMATICS
Type: BASIC
Degree: 409 - CHEMISTRY
Center: 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY
Year: 1
Main language: Spanish
Use of additional languages:
Web site:

Code: 57301
ECTS credits: 12
Academic year: 2022-23
Group(s): 20 23
Duration: AN
Second language: English
English Friendly: Y
Bilingual: N

Lecturer: **HENAR HERRERO SANZ** - Group(s): **20 23**

Building/Office	Department	Phone number	Email	Office hours
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Lecturer: **HELIA DA CONCEICAO PEREIRA SERRANO** - Group(s): **20 23**

Building/Office	Department	Phone number	Email	Office hours
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2. Pre-Requisites

To achieve the learning objectives is necessary knowledge and skills that are supposed to be guaranteed in the training prior to entering the university. In particular, basic knowledge of geometry, algebra and trigonometry, elementary mathematical operations (pow

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

As in any scientific discipline, in Chemistry, Mathematics is an indispensable tool for the understanding and development of any of its branches. Mathematics is the foundation and origin of modern theories of atomic and molecular structure, they allow to deal with pr

The mathematical concepts studied in the Mathematics course provide an essential tool and constitute a precise language that is used by most of the basic subjects. The subject of Mathematics helps to enhance the abstraction, rigor, analysis and synthesis capacitie

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

Description
Get used to teamwork, express yourself orally and in writing, and behave respectfully.
Knowing how to derive, integrate and represent functions of one and several variables, as well as the meaning and applications of the derivative and the integral.
Know how to model chemical processes through differential equations, solve them and interpret results.
Know how to use the language of Mathematics.
Know the matrix theory and know how to carry out the corresponding calculations.

6. Units / Contents

Unit 1: Linear Algebra
- **Unit 1.1** Matrix and determinants
- **Unit 1.2** Linear equations systems
- **Unit 1.3** Solving linear equations systems with MatLab

Unit 2: Vector Spaces
- **Unit 2.1** Definition of vector space
- **Unit 2.2** Vector subspaces
- **Unit 2.3** Linear combination. Generator systems
- **Unit 2.4** Linear independence and dependence
- **Unit 2.5** Basis. Dimension
- **Unit 2.6** Subspaces equations
- **Unit 2.7** Change of basis

Unit 3: Euclidean vector spaces
- **Unit 3.1** Scalar product. Euclidean vector space
- **Unit 3.2** Norm and angle
- **Unit 3.3** Orthogonality. Gram-Schmidt method

Unit 4: Linear transformations
- **Unit 4.1** Linear transformation
- **Unit 4.2** Kernel and image
- **Unit 4.3** Matrix representation
- **Unit 4.4** Operations
- **Unit 4.5** Change of basis

Unit 5: Eigenvalues and eigenvectors
- **Unit 5.1** Eigenvalues and eigenvectors
- **Unit 5.2** Proper subspaces
- **Unit 5.3** Diagonalizing a matrix
- **Unit 5.4** Diagonalizing a matrix with Matlab

Unit 6: One variable Integral and differential calculus
- **Unit 6.1** Limits and continuity
- **Unit 6.2** Derivative
- **Unit 6.3** Maximum and minimum. Convexity
- **Unit 6.4** Taylor polinomial
- **Unit 6.5** Definite and indefinite integrals
- **Unit 6.6** Improper integrals
- **Unit 6.7** Graphics, derivation and integrals with Matlab

Unit 7: Multivariable differential calculus
- **Unit 7.1** Multivariable functions
- **Unit 7.2** Global and directional limits. Continuity
- **Unit 7.3** Partial derivatives. Gradient
- **Unit 7.4** Chain rule
- **Unit 7.5** Taylor polinomial
- **Unit 7.6** Critical points. Maximum and minimum.
- **Unit 7.7** Lagrange multiplier method
- **Unit 7.8** Graphics, derivation and optimization with Matlab

Unit 8: Multiple integrals
- **Unit 8.1** Doble integrals
- **Unit 8.2** Triple integrals
- **Unit 8.3** Linear integral
- **Unit 8.4** Surface integral
- **Unit 8.5** Integration with Matlab

Unit 9: Ordinary differential equations
- **Unit 9.1** Introduction to differential equations
- **Unit 9.2** Solving first order differential equations
- **Unit 9.3** Solving second order differential equations
- **Unit 9.4** Qualitative properties of differential equationsof differential equations

Unit 9.5 Solving ordinary differential equations with Matlab

Unit 10: Systems of Ordinary differential equations

Unit 10.1 Solving systems of first order ordinary differential equation

Unit 10.2 Qualitative properties of systems of first order ordinary differential equations

Unit 10.3 Solving systems of ordinary differential equations with Matlab

ADDITIONAL COMMENTS, REMARKS

The contents are divided into 3 parts:

I. Linear Algebra (Unit 1 to Unit 5)

II. Integral and Differential Calculus (Unit 6 to Unit 8)

III. Ordinary Differential Equations (Unit 9 and Unit 10).

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	2.24	56	N	-	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	CB01 E17 G01	1.72	43	N	-	
Computer room practice [ON-SITE]	Practical or hands-on activities	CB01 E17 G01 T02	0.4	10	Y	Y	
Progress test [ON-SITE]	Assessment tests	CB01 E17 G01	0.08	2	Y	N	
Progress test [ON-SITE]	Assessment tests	CB01 E17 G01	0.24	6	Y	Y	
Final test [ON-SITE]	Assessment tests	CB01 E17 G01	0.12	3	Y	Y	
Study and Exam Preparation [OFF-SITE]	Self-study	T03 T05 T07 T08	7.2	180	N	-	
		Total:	**12**	**300**			
		Total credits of in-class work: 4.8					**Total class time hours: 120**
		Total credits of out of class work: 7.2					**Total hours of out of class work: 180**

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	20.00%	0.00%	Two progress test: one in the first semester and other one in the second semester.
Test	70.00%	90.00%	Three tests during the all course.
Assessment of activities done in the computer labs	10.00%	10.00%	Test using the software MATLAB.
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).

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	hours
Progress test [PRESENCIAL][Assessment tests]	3
Progress test [PRESENCIAL][Assessment tests]	6
Final test [PRESENCIAL][Assessment tests]	3

Unit 1 (de 10): Linear Algebra

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Computer room practice [PRESENCIAL][Practical or hands-on activities]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	10

Unit 2 (de 10): Vector Spaces

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	11

Unit 3 (de 10): Euclidean vector spaces

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	10

Unit 4 (de 10): Linear transformations

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	11

Unit 5 (de 10): Eigenvalues and eigenvectors

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Computer room practice [PRESENCIAL][Practical or hands-on activities]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	10

Unit 6 (de 10): One variable Integral and differential calculus

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	9
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	6
Computer room practice [PRESENCIAL][Practical or hands-on activities]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	26

Unit 7 (de 10): Multivariable differential calculus

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	8
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	6
Computer room practice [PRESENCIAL][Practical or hands-on activities]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	25

Unit 8 (de 10): Multiple integrals

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	8
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	7
Computer room practice [PRESENCIAL][Practical or hands-on activities]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	25

Unit 9 (de 10): Ordinary differential equations

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	7
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	6
Computer room practice [PRESENCIAL][Practical or hands-on activities]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	28

Unit 10 (de 10): Systems of Ordinary differential equations

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	6
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	6
Computer room practice [PRESENCIAL][Practical or hands-on activities]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	24

Global activity

Activities	hours
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	42
Class Attendance (theory) [PRESENCIAL][Lectures]	56
Computer room practice [PRESENCIAL][Practical or hands-on activities]	10
Progress test [PRESENCIAL][Assessment tests]	3
Progress test [PRESENCIAL][Assessment tests]	6
Final test [PRESENCIAL][Assessment tests]	3

Study and Exam Preparation [AUTÓNOMA][Self-study]	180
	Total horas: 300

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Zill, D. G.	Ecuaciones diferenciales con problemas de valor en la frontera	Cengage Learning,			2018	
Zill, D. G.; Wright, W. S.	Matemáticas V. Ecuaciones Diferenciales	Cengage Learning,			2018	
Larson, R.; Edwards, B.	Cálculo 2 de varias variables	McGraw Hill		9789701071342	2009	
Larson, R.; Edwards, B.; Falvo, D.	Álgebra Lineal	Grupo Anaya Comercial		9788436820607		
Stewart, J.	Cálculo de una variable	Thomson Learning		9789706860699	2001	
Stewart, J.	Cálculo multivariable	Thomson Learning		9789706861238	2002	
Thomas, G.	Cálculo de una variable	Pearson		9702606438	2005	
Thomas, G.	Cálculo de varias variables	Pearson		9789702606444	2006	
Zill, D.	Ecuaciones diferenciales con aplicaciones de modelado	Thomson		9687529210	2007	
Larson, R., Edwards, B. H.	Calculus	Cengage Learning,		978-1337275347	2017	
Quarteroni, A., Saleri, F., Gervasio, P.	Scientific Computing with Matlab and Octave	Springer		978-3-642-45366-3	2014	
Lay	Linear Algebra and its applications	Pearson International		978-1292092232	2015	
Zill, D. G.	First course in Differential equations with modeling applications	Cengage Learning,			2018	
Larson, R.	Elementary Linear Algebra	Wadsworth Publishing Co		978-1133110873		
Larson, Ron (1941-)	Cálculo 1 : de una variable /	McGraw-Hill,		978-607-15-0273-5	2010	
Quarteroni, Alfio	Cálculo científico con MATLAB y Octave /	Springer-Verlag Italia,		88-470-0503-5	2006	
Stewart, James (1941-)	Multivariable calculus /	Cengage Learning,		978-1-305-26673-5	2016	
Zill, D. G.	Differential Equations with Boundary-Value Problems	Cengage Learning,			2018	