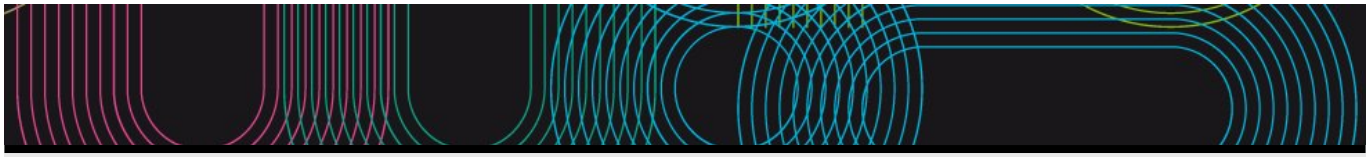

IDENTIFYING DATA				
Mathematics: Mathematics II				
Subject	Mathematics: Mathematics II			
Code	V11G200V01203			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Mirás Calvo, Miguel Ángel Verdejo Rodríguez, Amelia			
Lecturers	Mirás Calvo, Miguel Ángel Verdejo Rodríguez, Amelia			
E-mail	mmiras@uvigo.es averdejo@uvigo.es			
Web	http://http://faitic.uvigo.es/			
General description	This course covers theoretical and practical topics of Calculus (several variables), optimization e statistics. It is intended to improve the student's abilities in comprehension and use of mathematical language. It will also give the student the necessary general computation skills and the basic knowledge of mathematics-oriented software.			

Competencies	
Code	
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
C22	Process and perform computational calculations with chemical information and chemical data
C23	Present oral and written scientific material and scientific arguments to a specialized audience
C29	Demonstrate skills for numerical calculations and interpretation of experimental data, with special emphasis on precision and accuracy
D1	Communicate orally and in writing in at least one of the official languages of the University
D3	Learn independently
D4	Search and manage information from different sources
D5	Use information and communication technologies and manage basic computer tools
D6	Use mathematics, including error analysis, estimates of orders of magnitude, correct use of units and data representations
D7	Apply theoretical knowledge in practice
D8	Teamwork
D9	Work independently
D12	Plan and manage time properly
D13	Make decisions
D14	Analyze and synthesize information and draw conclusions
D15	Evaluate critically and constructively the environment and oneself

Learning outcomes		
Expected results from this subject	Training and Learning Results	
To relate curves and surfaces with geometrical objects and functions of several variables.	C29	D6 D9
To compute the volume of three-dimensional domains and basic surface integrals as well as using polar, spherical and cylindrical coordinates.	C29	D6
To apply the basic notions and rules of the calculus of several variables.	C29	D3 D6 D9

Differentiating implicitly		C23	D3 D9
To express and solve optimization problems without constraints		C23 C29	D1 D3 D4 D6 D7 D14
To model and solve practical problems using differentiable and integral calculus techniques.		C22 C23 C29	D3 D6 D7 D9 D12 D13 D14
To use an appropriate graphic, numerical and symbolical software to solve practical problems of calculus of several variables.		C22 C29	D4 D5 D6 D7 D13 D14
To compute eigenvalues and check whether a matrix is diagonalizable.		C29	D3 D6 D9
To stablish the definiteness of a quadratic form.		C29	D3 D6 D9
To use adequate software to solve linear algebra problems.		C22 C29	D3 D4 D5 D6 D7 D9 D12 D13 D14
To perform a descriptive statistical data analysis		C22 C29	D4 D5 D6 D7 D9 D12 D13 D14
To compute probabilities in different spaces and apply the concept of random variable to model real situations.		C23 C29	D3 D6 D9
To use basic statistical software.		C22 C23 C29	D1 D4 D5 D6 D7 D14
To write or make and oral presentation of mathematical concepts.	A4	C23	D1 D3 D4 D5 D8 D12 D13 D14 D15

Contents	
Topic	
Chapter 1: Eigenvalues and symmetric matrices	Computation of eigenvalues. Diagonalizable matrices. Sign of a quadratic form

Chapter 2: Calculus of several variables	Intoduction to real funcions of several variables. Continuous and differentiable functions. Higher order derivatives. The chain rule. Implicit differentiation. Computation of extreme points
Chapter 3: Multiple integration	Integrals of functions of two and three variables on bounded domains. Polar, spherical and cylindrical coordinates. Surface Integrals
Chapter 4: Basic Statistics	Descriptive statistics Introduction to probability

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	20	30	50
Troubleshooting and / or exercises	26	36	62
Practice in computer rooms	6	3	9
Long answer tests and development	3	20	23
Practical tests, real task execution and / or simulated.	0	6	6

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Master Session	The teachers will lecture on the theoretical foundations of the topics cover in the course; they will present possible applications; they will formulate problems, questions and exercises; and they will propose tasks and activities with orientations on the methods and techniques needed.
Troubleshooting and / or exercises	In this activity, the students, individually or in group, must solve problems and exercises. The students must be able to find a convincing mathematical model, use the appropriate technique according to the available information and give a sound interpretation of the results.
Practice in computer rooms	Activities designed to learn how to use mathematical software to make numerical computations and plotting of functions and data.

Personalized attention

Methodologies	Description
Troubleshooting and / or exercises	Each student can ask the teachers for advise and guidance related to the contents and activities of the course. They will be attended during tutorial hours.
Practice in computer rooms	Questions and doubts related to the computer classes will be attended during tutorial hours.

Assessment

	Description	Qualification	Training and Learning Results		
Troubleshooting and / or exercises	The student must solve some given problems and exercises within the time and under the conditions specified by the teacher. The activities can be of very different types: go out to the blackboard, written assingment, oral presentation, puzzle,...	15	A4	C23	D1 D3 D4 D6 D7 D8 D9 D12 D13 D14 D15
Long answer tests and development	Final exam. A formal individual examination consisting on theoretical and practical questions that will take place right after the classes period.	80		C22 C29	D3 D6 D7 D9 D12 D13 D14

Practical tests, real task execution and / or simulated.	Practical exercise to evaluate the student degree of knowledge and application of the mathematical software used in the lab clasess.	5	C22 C29	D4 D5 D6 D7 D14

Other comments on the Evaluation

Second call (failed subject):

To pass the subject the student must obtained a global score greater or equal than 50% of the possible highest score.

The student who fail the subject in the first call must repeat the final exam in July. The other marks will be maintained.

A final mark or qualification will be assigned to those students who attend any of the final exams.

Sources of information

Basic Bibliography

Complementary Bibliography

Robert G. Mortimer, **Mathematics for physical chemistry**, Elsevier, 2013

Besada, M.; García, J.; Mirás, M.; Vázquez, C., **Cálculo diferencial en varias variables**, Garceta, 2011

E. Steiner, **The Chemistry Maths Book**, Oxford University Press, 2008

Besada, M.; García, J.; Mirás, M.; Quinteiro, C.; Vázquez, C., **Un mar de Matemáticas. Matemáticas para os graos de Ciencias**, Servicio de Publicacións. Universidade de Vigo, 2016

Real Sociedad Matemática Española, **Centro virtual de divulgación de las Matemáticas**,

Proxecto Innovación Educativa. Universidade de Vig, **Matemáticas a través do teatro**,

R. Larson, R. Hostetler; B. H. Edwards, **Cálculo esencial**, Itemex, 2010

Robert A. Adams; Christopker Essex, **Calculus. A complete course**, Pearson, 2013

William Bober, Chi-Tay Tsai; Oren Masory, **Numerical and analytical methods with MATLAB**, CRC Press, 2013

Dingyu Xue; Yangquan Chen, **Solving applied mathematical problems with MATLAB**, CRC Press, 2009

Recommendations

Subjects that continue the syllabus

Numerical methods in chemistry/V11G200V01402

Subjects that are recommended to be taken simultaneously

Physics: Physics II/V11G200V01201
Geology: Geology/V11G200V01205
Chemistry, physics and geology: Integrated laboratory II/V11G200V01202
Chemistry: Chemistry 2/V11G200V01204

Subjects that it is recommended to have taken before

Biology: Biology/V11G200V01101
Physics: Physics I/V11G200V01102
Mathematics: Mathematics I/V11G200V01104
Chemistry, physics and biology: Integrated laboratory I/V11G200V01103
Chemistry: Chemistry I/V11G200V01105