Subject Guide

1. Information about the subject

SUBJECT	Mathematics	**CODE**	GQUIMI01-1-005
EDUCATIONAL OFFER	Bachelor´s Degree in Chemistry	**CENTER**	Facultad de Química
TYPE	Core	**N° TOTAL CREDITS**	12.0
PERIOD	Annual	**LANGUAGE**	Spanish English

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2. Context

The course, which forms a part of the basic module and the Mathematics subject is clearly instrumental, its contents and methods being useful for all the materials that shape the Chemistry Degree. In any case, we highlight its links with some subjects with particular mathematical contents: Physics, Statistics and Numerical Analysis and subjects related to the area of Physical Chemistry. In fact, it is required to pass this subject to study the material of Physical Chemistry in the central (fundamental) module.

The course should provide the necessary mathematical techniques to use in other subjects. The methods of deductive reasoning of mathematics will also help students confront very diverse scientific problems.

The material must enable the student to handle basic mathematical techniques when modeling problems that can arise in the context of his or her work: industry and/or research , teaching, etc.

The course will be taught by José Gabriel Garcia Rodríguez (University of Oviedo, Department of Mathematics, Section of Applied Mathematics).

3. Requirements

It is recommended that students have taken Mathematics in the their last two years at High School, either in Natural Science and Health or in Science and Technology. Although key concepts of Calculus and Algebra (limits, derivatives, integrals, matrices) will be reviewed, a good prior knowledge of these concepts is highly recommended.

4. Competencies and learning results

In the course the following general competencies will be looked at:

1. Demonstrate the ability to analyze and synthesize (CG-1)
2. Solve problems effectively (CG-2)
3. Properly manage the information (CG-6).

4. Develop critical thinking (CG-17)
5. Team work (CG-18).

Learning outcomes:

1. To master the basics of Algebra and Differential and Integral Calculus of one and several variables, matrices, derivatives, partial derivatives, integrals, multiple integrals and differential equations. The evaluation of this subject area will be done by exams and group tutorials.

2. Pose and solve problems in the field of mathematics. The development of group tutorials in which problems are posed for the student to solve, individually or in a group, outside the classes as well as doing exams which will include problems, will allow the adequacy of the learning outcome to the proposed competencies to be evaluated.

3. Demonstrate and use with ease basic scientific knowledge acquired in this course . This learning outcome will be assessed by examination, as well as student participation in seminars and group tutorials.

4. Correct use of basic mathematical terminology, expressing ideas with the precision required in science, while being able to establish relationships between different concepts. This learning outcome will be assessed by examination.

5. Use of computer tools. The Mathematics subject will hold workshops in which students will learn to handle computer tools related to the subject, and with applications in other areas.

6. Develop and correctly present a report, both orally and in writing. In the proposed interdisciplinary activities, students must read a text of popular science related to Mathematics and prepare a summary sheet that he will present orally to peers and faculty. A group project on a topic proposed by the teaching team must also be carried out and a summary of the work must be presented on a poster and debated with their peers.

5. Contents

1. Differential Calculus of functions of one variable (14 hours)

1.1 Limits and continuity
1.2 Derivative of a function
1.3 Applications: Maximum and minimum. Graphing

2. Linear Algebra (8 hours)

2.1 Vectorial spaces
2.2 Linear applications
2.3 Matrices

3. Differential Calculus of functions of several variables (18 hours)

3.1 Limits and continuity
3.2 Partial derivatives. Jacobian matrix
3.3 The chain rule
3.4 Optimization

4. Integral Calculus of functions of one variable (20 hours)

4.1 Antiderivatives. Techniques of integration
4.2 The definite integral. The fundamental theorem of Calculus
4.3 Applications: areas and volumes
4.4 Improper integrals

5. Multiple integrals (14 hours)

5.1 Double integrals. Fubini's theorem
5.2 Change of variables. Polar coordinates
5.3 Triple integrals
5.4 Change of variables. Spherical and cylindrical coordinates
5.5 Applications

6. Line and surface integrals (18 hours)

6.1 Plane and space curves
6.2 Line integrals. Work. Length
6.3 Conservative fields
6.4 Surfaces
6.5 Surface integrals. Area

7. Differential equations (14 hours)

7.1 First order differential equations
7.2 Second order differential equations

6. Methodology and working plan

Items	***Total hours***	*Lectures*	*Practical sessions*	*Grupal Tutorials*	*Joined activities*	*Evaluation sessions*	***Total***	*Team work*	*Individual work*	**Total**
1	32	11	2	1			14		18	18
2	16	5	1				8		12	12
3	48	16	2	2			18		26	26
4	53	15	3	2			20		33	33
5	39	11	2	1			14		25	25
6	51	15	2	1			18		33	33
7	39	11	2	1			14		25	25
Others	22				8	6	14	8		8
Total	**300**	**84**	**14**	**8**	**8**	**6**	**120**	**8**	**172**	**180**

Total volume of student work:

TYPES	Hours	%	Totals

In-class activities	Lectures	84	28	120	
	Practical sessions	14	4,67		
	Tutorías grupales	8	2,67		
	Joined activities	8	2,67		
	Evaluation sesscion	6	2,00		
Out-of-class activities	Team work	8	2,67	180	
	Individual work	172	57,33		
	Total	300			

In the lectures, the teacher will explain the relevant material, carrying out exercises and examples to help students' understanding of same.

The group tutorials will allow the student to participate by asking questions on the material which has not been fully understood. For this, the teacher will prepare in advance for each tutorial group a series of exercises and/or problems of the same level as the exercises performed in the lectures and classroom practicals; the student will have to solve these problems in his own time. In group tutorials the students will be asked and examined on the exercises previously proposed. Fundamentally, group tutorials should be participatory to the extent that the tutor can determine the degree of comprehension of the subject by the students.

Classroom practices will mainly concern students solving exercises individually and in groups.

For methodology of joint activities with other areas see the guide of each of these activities.

7. Evaluation of the student's learning results

Ordinary examination
The exam mark will account for 80% of the final grade, the assessment group tutorials for 15% and other activities for 5%.
There will be two partial exams, corresponding respectively to the subjects taught in the 1st and 2nd semester of the course. For the students who have passed the two exams, the final result will be the arithmetic mean of the marks of both exams. In the final exam (exam session May) students who have passed a partial examination may be examined only on the exam not passed.

To pass the course it is necessary to pass the part of the evaluation corresponding to exams.
The evaluation activities of group tutorials will include the completion and submission of papers and exercises.
Other activities include a reading workshop, an interdisciplinary seminar, etc...

Exams	80%
Grupal tutorials	15%
Other activities	5%

Extraordinary examinations

The extraordinary examinations of January and July will consist of a written test which will account for 100% of the final marks.

8. Resources, bibliography and complementary documentation

Textbook:
Stewart, J. Calculus. Cengage Learning, 2012.

Aditional book:
Thomas' Calculus. Pearson, 2009.

Other resources:
Lecture notes and problem sets on e-Campus.