



IDENTIFYING DATA

Mathematics: Calculus 1

Subject	Mathematics: Calculus 1		
Code	V05G300V01105		
Study programme	Degree in Telecommunications Technologies Engineering		
Descriptors	ECTS Credits	Choose	Year
	6	Basic education	1st
Teaching language	Spanish Galician		
Department	Applied Mathematics II		
Coordinator	Calvo Ruibal, Natividad		
Lecturers	Calvo Ruibal, Natividad Fernández Manin, Generosa González Rodríguez, Ramón Loureiro García, Marcos		
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General description	<p>The aim of this subject is to introduce the student in the basic techniques of Differential Calculus in one and several real variables and its applications.</p> <p>At the end of the semester it is expected that students have achieved the understanding of the basic concepts, handle the usual differential operators of the mathematical physics and learn the techniques of differential calculus for the determination of extremes local approximation of functions and numerical solution of systems of equations. Besides, he will learn to handle some computer programs of symbolic calculation and graphic representation.</p>		

Competencies

Code	
B3	CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations
B4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
C1	CE1/FB1: The ability to solve mathematical problems in Engineering. The aptitude to apply knowledge about linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial differential equations; numerical methods, numerical algorithms, statistics and optimization
D2	CT2 Understanding Engineering within a framework of sustainable development.
D3	CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc.

Learning outcomes

Expected results from this subject	Training and Learning Results		
Understanding of the basic concepts of the differential calculation in one and several variables.	B3 B4	C1	D2 D3
Knowledge and handle of the usual differential operators of the mathematical physics.		C1	

Knowledge and handle of the technicians of differential calculation for the research of extremes, the local approximation of functions and the numerical resolution of systems of equations.	B4	C1	D2
Knowledge of some computer program of symbolic calculation and graphic representation.	B3		D3

Contents

Topic	
Topic 1. Introduction.	Sets of numbers and functions of one variable.
Topic 2. n-dimensional space.	Scalar product, norm. Vector product. Polar, cylindrical and spherical coordinates.
Topic 3. Continuity of functions of one variable.	Limit of a function in a point. One-sided limits. Continuity. The intermediate value theorem. Bolzano's theorem. The bisection method.
Topic 4. Continuity of functions of several variables.	Functions of several variables. Limits. Continuity. Bolzano's theorem.
Topic 5. Derivatives of functions of one variable.	Derivatives of a function in a point. Derivative function, successive derivatives, properties. Chain rule. Implicit differentiation. Derivative of inverse functions.
Topic 6. Applications of the derivative.	Maxima and minima. Mean value theorem. L'Hopital's rule. Local study of the graph of a function. Taylor polynomials. Newton's method.
Topic 7. Differential of functions of several variables.	Directional derivatives. Partial derivatives. Jacobian matrix. The chain rule. Higher order derivatives. Differential operators.
Topic 8. Applications of the differential calculation.	Extreme values. Extreme values with equality constraints. Newton's method.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	38	66.5	104.5
Problem solving	10	14	24
Laboratory practices	2	1.5	3.5
Problem solving	4	8	12
Problem solving	2	4	6

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

Methodologies

	Description
Lecturing	The teacher will expose the theoretical contents of the matter. Through this methodology competencies CG3, CE1 and CT3 are developed.
Problem solving	The teacher will solve problems and exercises of each of the topics and the student will have to solve similar exercises. Through this methodology competencies CG3, CG4, CE1, CT2 and CT3 are developed.
Laboratory practices	The students will use computer tools (Maxima and/or Matlab) to solve exercises and apply the knowledge achieved in the theoretical classes. Through this methodology competencies CG3, CG4, CE1, CT2 and CT3 are developed.

Personalized attention

Methodologies Description

Lecturing	The teacher will attend personally the doubts and queries of the students in the schedule of personal tutorials at the teacher's office or by email.
Problem solving	The teacher will attend personally the doubts and queries of the students in the schedule of personal tutorials at the teacher's office or by email.

Assessment

Description	Qualification	Training and Learning Results
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Problem solving	First session (1 hour): Topic 1.	5	B3	C1
	Second session (1 hour): Topics 2, 3 and 4.		B4	
	Third session (1 hour): Topics 5 and 6.	17.5		
	Fourth session (1 hour): Topic 7.	10		
	The four previous sessions give 50% of the course mark.	17.5		
	Individual assessment.	50		
Problem solving	Final exam on topics 7 and 8 of the subject. Its grading will be 50% of the course mark.	50	B4	C1
	Individual assessment.			

Other comments on the Evaluation

Following the guidelines of the degree, two evaluation systems will be offered to the students: continuous assessment or eventual assessment.

1. Continuous assessment

In order to opt for continuous assessment student should complete a registration form for this type of evaluation and deliver it to the corresponding teacher by September 22nd. After then it will not be possible to change the option of evaluation. Continuous assessment consists of the previous four one-hour sessions detailed and a final exam on topics 7 and 8. If a student cannot attend a particular test on the date for which it is scheduled, he or she will miss that test.

In this case, the final grading for a student is given by the formula:

$$N = (1/10) \times C + (5/10) \times E$$

C: grading, between 0 and 50, obtained as the sum of the marks of the four one-hour sessions.

E: grading, between 0 and 10, obtained in the final exam on the topics 7 and 8 of the subject.

In this mode, a student has successfully completed the course when **N** is greater than or equal to 5. Gradings obtained in the tests will be valid only for the academic year in which they are done.

2. Eventual assessment and extraordinary call

Those students who do not choose to be graded by continuous assessment, will be graded by means of a final exam (topics: 1, 2, 3, 4, 5, 6, 7, and 8) which will not necessarily be the same as the one for the students who choosed continuous assessment. This exam will be graded in a scale of 10 points and the passing grade cutoff will be 5.

3. Second call

On the day of this second final exam, the students who were graded by continuous evaluation may choose to be graded exclusively by this second exam or to be graded taking into account the points obtained in their continuous evaluation by the same formula used earlier, that is:

$$NR = (1/10) \times C + (5/10) \times D$$

C: Mark, between 0 and 50, obtained as the sum of the gradings of the one-hour sessions.

D: Mark, between 0 and 10, obtained in an exam on the topics 7 and 8 of the subject.

In this mode, a student has successfully completed the course when **NR** is greater than or equal to 5.

Those students who choose to be graded exclusively by the second final exam on topics: 1, 2, 3, 4, 5, 6, 7, and 8 which will not necessarily be the same as the one for the students who made the other choice. This exam will be graded in a scale of 10 points and the passing grade cutoff will be 5.

4. Qualification of "No Presentado"

A student will obtain a qualification of "No Presentado" if he did not choose continuous evaluation and did not attend the final exams.

5. Ethical behaviour

It is expected a correct and ethical behavior of all students in all written tests and exams, which are meant to truly reflect the knowledge and abilities attained by each student. Any unethical behavior detected in a particular test (such as copying or using prohibited material) will result in a grading of 0 in that test and the issue of the corresponding report for the School Director's Office.

Sources of information

Basic Bibliography

J. Stewart, **Cálculo de una variable: conceptos y contextos.**, 4ª edición,

E. Marsden y A.J. Tromba, **Cálculo vectorial**, 6ª edición,

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Physics: Analysis of Linear Circuits/V05G300V01201

Physics: Fields and Waves/V05G300V01202

Mathematics: Calculus 2/V05G300V01203

Mathematics: Probability and Statistics/V05G300V01204

Digital Signal Processing/V05G300V01304

Electromagnetic Transmission/V05G300V01303

Subjects that are recommended to be taken simultaneously

Mathematics: Linear algebra/V05G300V01104