



## IDENTIFYING DATA

### Mathematics: Calculus 1

Subject	Mathematics: Calculus 1			
Code	V05G306V01101			
Study programme	Bachelor Degree in Telecommunication Technologies Engineering (BTTE)			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Fernández Manin, Generosa			
Lecturers	Fernández Manin, Generosa González Rodríguez, Ramón Prieto Gómez, Cristina Magdalena			
E-mail	gmanin@uvigo.es			
Web	<a href="http://moovi.uvigo.gal">http://moovi.uvigo.gal</a>			
General description	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. 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, the student will learn to handle some computer programs of symbolic calculation and graphic representation.			

## Training and Learning Results

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.

## Expected results from this subject

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	

<b>Contents</b>	
Topic	
Topic 1. Introduction.	Sets of numbers and functions of one variable.
Topic 2. 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 3. Continuity of functions of several variables.	n-dimensional space. Inner product, Norm. Vector product. Functions of several variables. Limits. Continuity. Bolzano's theorem.
Topic 4. Derivatives of functions of one variable and applications of the derivative.	Derivatives of a function at a point. Derivative function, successive derivatives, properties. Chain rule. Implicit differentiation. Derivative of inverse functions. Maxima and minima. Mean value theorem. L'Hopital's rule. Local study of the graph of a function. Taylor polynomials. Newton's method.
Topic 5. Differential of functions of several variables.	Directional derivatives. Partial derivatives. Jacobian matrix. The chain rule. Higher order derivatives. Differential operators.
Topic 6. Applications of the differential calculus.	Extreme values. Extreme values with equality constraints. Newton's method.

<b>Planning</b>			
	Class hours	Hours outside the classroom	Total hours
Lecturing	47	61.5	108.5
Problem solving	9	14	23
Laboratory practical	2	1.5	3.5
Problem and/or exercise solving	1	1	2
Problem and/or exercise solving	1	2	3
Problem and/or exercise solving	1	3	4
Problem and/or exercise 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.

<b>Methodologies</b>	
	Description
Lecturing	The teachers will expose the theoretical contents of the matter.
	Through this methodology competencies CG3, CE1 and CT3 are developed.
Problem solving	The teachers 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 practical	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 assistance

Methodologies	Description
Lecturing	The teachers will discuss personally the doubts and queries of the students in the schedule of personal tutorials ( <a href="http://moovi.uvigo.gal">http://moovi.uvigo.gal</a> ) in person, whenever this is possible, and also by the distance learning method, through appointment modality, using the telematic means provided by the Universidade of Vigo.
Problem solving	The teachers will discuss personally the doubts and queries of the students in the schedule of personal tutorials ( <a href="http://moovi.uvigo.gal">http://moovi.uvigo.gal</a> ) in person, whenever this is possible, and also by the distance learning method, through appointment modality, using the telematic means provided by the Universidade of Vigo.

<b>Assessment</b>			
	Description	Qualification	Training and Learning Results
Problem and/or exercise solving	First session (1 hour): Topic 1.	10	B3 C1
Problem and/or exercise solving	Second session (1 hour): Topics 2 and 3.	20	B4 C1
Problem and/or exercise solving	Third session (1 hour): Topics 4 and 5.	30	B3 B4 C1
Problem and/or exercise solving	Final exam on topics 5 and 6 of the subject.	40	B4 C1

## Other comments on the Evaluation

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

### 1. Continuous assessment

It will be considered that the student has opted for continuous evaluation if he/she attends the Second Session (Topics 2 and 3). After then it will not be possible to change the option of evaluation. Continuous assessment consists of the previous three one-hour sessions detailed and a final exam. 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:

$$N = C + E$$

**C:** grading, between 0 and 6, obtained as the sum of the marks of the three one-hour sessions.

**E:** grading, between 0 and 4, obtained in the final exam on the topics 5 and 6 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. Global assessment and end-of-program 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, and 6) which will not necessarily be the same as the one for the students who chose continuous assessment. This exam will be graded in a scale of 10 points and the passing grade cutoff will be 5.

### 3. Extraordinary exam

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:

$$NR = C + D$$

**C:** Mark, between 0 and 6, obtained as the sum of the gradings of the one-hour sessions.

**D:** Mark, between 0 and 4, obtained in an exam on the topics 5 and 6 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, and 6 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 the student 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 incident will be reported to the corresponding academic authorities for prosecution.

### 6. English Friendly

English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.

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#### Sources of information

##### Basic Bibliography

J. Stewart, **Cálculo de una variable: conceptos y contextos.**, 4ª edición, Cengage Learning, 2011

E. Marsden y A.J. Tromba, **Cálculo vectorial**, 6ª edición, Pearson, 2018

##### Complementary Bibliography

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**Recommendations**

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**Subjects that continue the syllabus**

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Physics: Analysis of Linear Circuits/V05G301V01108

Mathematics: Calculus 2/V05G301V01106

Mathematics: Probability and Statistics/V05G301V01107

Physics: Fields and Waves/V05G301V01202

Digital Signal Processing/V05G301V01205

Electromagnetic Transmission/V05G301V01207

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**Subjects that are recommended to be taken simultaneously**

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Mathematics: Linear algebra/V05G301V01102

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