# Universidade Vigo

## IDENTIFYING DATA
### Mathematics: Calculus 1

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|---|---|
| Subject | Mathematics: Calculus 1 |
| Code | V05G300V01105 |
| Study programme | Degree in Telecommunications Technologies Engineering |

| Descriptors | ECTS Credits | Choose | Year | Quadmester |
|---|---|---|---|---|
| | 6 | Basic education | 1st | 1st |

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|---|---|
| Teaching language | Spanish |
| Department | |
| Coordinator | Calvo Ruibal, Natividad |
| Lecturers | Calvo Ruibal, Natividad<br>Fernández Manin, Generosa<br>González Rodríguez, Ramón |
| E-mail | nati@dma.uvigo.es |
| Web | http://faitic.uvigo.es |
| General description | The aim that pursue with this subject is that the student know the basic technicians of the differential calculation in one and several real variables and his applications. Al term of this subject it expects that the student have achieved the understanding of the basic concepts of the differential calculation in one and several variables, the handle of the usual differential operators of the mathematical physics and of the technicians of differential calculation for the research of extremes, local approximation of functions and numerical resolution of systems of equations. Besides, it will have to know handle some computer program of symbolic calculation and graphic representation. |

## 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<br>B4 | C1 | D2<br>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 | |
|---|---|
| Subject 1. Introduction. | Sets of numbers and functions of one variable. |
| Subject 2. n-dimensional space. | Scalar product, norm. Vectorial product. Polar, cylindrical and spherical coordinates. |
| Subject 3. Continuity of functions of one variable. | Limit of a function in a point. Lateral limits. Continuity. Theorem of the intermediate value. Theorem of Bolzano. Method of bisection. |
| Subject 4. Continuity of functions of several variables. | Functions of several variables. Limits. Continuity. Theorem of Bolzano. |
| Subject 5. Derivation of functions of one variable. | Derivation of a function in a point. Derivative function, derivative successive, properties. Rule of the chain. Implicit derivation. Derivation of reverse functions. |
| Subject 6. Applications of the derivative. | Maxima and minimum. Theorem of the mean value. Rule of L'Hopital. Local study of the graphic of a function. Taylor polynomial. Method of Newton. |
| Subject 7. Differential of functions of several variables. | Directional derivatives. Partial derivatives. Jacobian matriz. Rule of the chain. Higher order derivatives. Differential operators. |
| Subject 8. Applications of the differential calculation. | Extreme values. Extreme values with equality constraints. Method of Newton. |

## Planning

| | Class hours | Hours outside the classroom | Total hours |
|---|---|---|---|
| Master Session | 38 | 66.5 | 104.5 |
| Troubleshooting and / or exercises | 10 | 14 | 24 |
| Laboratory practises | 2 | 1.5 | 3.5 |
| Troubleshooting and / or exercises | 4 | 8 | 12 |
| Troubleshooting and / or exercises | 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 |
|---|---|
| Master Session | The professor will expose the theoretical contents of the matter.<br><br>Through this methodology the competencies CG3, CE1 and CT3 are developed. |
| Troubleshooting and / or exercises | The professor will resolve problems and exercises of each one of the subjects and the student will have to resolve similar exercises.<br><br>Through this methodology the competencies CG3, CG4, CE1, CT2 and CT3 are developed. |
| Laboratory practises | The students will use computer tools (Maxima and/or Matlab) to resolve exercises and apply the knowledge purchased in the theoretical classes.<br><br>Through this methodology the competencies CG3, CG4, CE1, CT2 and CT3 are developed. |

## Personalized attention

| Methodologies | Description |
|---|---|
| Master Session | The professor will attend personally the doubts and queries of the students in the schedule of tutorías or by means of email. |
| Troubleshooting and / or exercises | The professor will attend personally the doubts and queries of the students in the schedule of tutorías or by means of email. |

## Assessment

| | Description | Qualification | Training and Learning Results |
|---|---|---|---|

| Troubleshooting and / or exercises | First session (1 hour): Subject 1. (Aprox. week 4). | 5 | B3 B4 | C1 |
| --- | --- | --- | --- | --- |
| | Second session (1 hour): Subjects 2, 3 and 4. (Aprox. week 8). | 17.5 | | |
| | Third session (1 hour): Subjects 5 and 6. (Aprox. week 11). | 10 | | |
| | Fourth session (1 hour): Subject 7. (Aprox. week 14). | 17.5 | | |
| | The four previous sessions add 50% of the total note. | 50 | | |
| Troubleshooting and / or exercises | Final examination on the subjects 7 and 8 of the matter. The punctuation will be 50% of the total note. | 50 | B4 | C1 |

## Other comments on the Evaluation

### 1. Continuous evaluation

A student has opted by the continuous evaluation when he delivers to the teacher (before September 22) the sheet of registration in this type of evaluation. It will not be able to change the option of evaluation. If a student cannot attend a particular test on the date for which it is scheduled, he or she will miss that test and it will not be repeated.

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

**N = (1/10) x C + (5/10) x E**

**C**: qualification, between 0 and 50, obtained as the sum of the qualifications of the four sessions of an hour.

**E**: qualification, between 0 and 10, obtained in the final examination on the subjects 7 and 8 of the matter.

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

### 2. Evaluation at the end of the semester

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

### 3. Second chance

The students who at the end of the semester do not obtain a passing grade will have the opportunity of writing a second final exam on date, time and venue determined in the official exams calendar of the School. On the day of this second final, the students who were graded by continuous evaluation may choose to be graded exclusively by the second final 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) x C + (5/10) x D**

**C**: Note, between 0 and 50, obtained as the sum of the qualifications of the sessions of an hour.

**D**: Note, between 0 and 10, obtained in an examination on the subjects 7 and 8 of the matter.

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

The students who choose to be graded exclusively by the second final will write an exam (subjects: 1, 2, 3, 4, 5, 6, 7, and 8) and which will not be necessarily the same as the one for the students who made the opposite choice. This exam will be graded in a scale of 10 points and the passing gradecutoff will be 5.

### 4. Qualification of '' Not Present''

A student will obtain a qualification of ''Not Present'' if he did not choose the continuous evaluation and he 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.

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## Sources of information
**Basic Bibliography**

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

E. Marsden y A.J. Tromba, **Cálculo vectorial**, 5ª edición,

**Complementary Bibliography**

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## 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