Calculus

Code: 103796
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500895 Electronic Engineering for Telecommunication	FB	1
2500898 Telecommunication Systems Engineering	FB	1

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Although there are no official prerequisites, it is essential that students have a very good command of the most basic notions of mathematics. It will also be of great use to them if they already have consolidated knowledge of Calculus taught in High School: limits, continuity and derivability of real functions of a real variable; notions of integral calculus. People who do not have a minimum background in previous mathematics will have to make an effort to worry about solving these deficiencies.

Objectives and Contextualisation

Reach a sufficient level in the calculation of a variable to deal with phenomena and solve the mathematical problems raised in engineering that can be described in these terms.

Support the parts of the other subjects of the degree that require mastery of real functions of a variable. Achieve a sufficient level in the use of complex numbers and above all in trigonometry.

Competences

Electronic Engineering for Telecommunication

- Communication
- Develop personal attitude.
- Develop personal work habits.
- Develop thinking habits.
- Learn new methods and technologies, building on basic technological knowledge, to be able to adapt to new situations.
- Work in a team.

Telecommunication Systems Engineering

- Communication
- Develop personal attitude.
- Develop personal work habits.
- Develop thinking habits.
- Learn new methods and technologies, building on basic technological knowledge, to be able to adapt to new situations.
- Work in a team.

Learning Outcomes

1. Apply, in the problems that arise in engineering, knowledge about linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial derivative equations, numerical methods, numerical algorithms, statistics and optimisation.
2. Apply, to the problems that arise in engineering, knowledge of linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial derivative equations, numerical methods, numerical algorithms, statistics and optimisation.
3. Communicate efficiently, orally and in writing, knowledge, results and skills, both professionally and to non-expert audiences.
4. Develop curiosity and creativity.
5. Develop scientific thinking.
6. Develop the capacity for analysis and synthesis.
7. Manage available time and resources.
8. Manage available time and resources. Work in an organised manner.
9. Prevent and solve problems.
10. Resolve the mathematical problems that can arise in engineering.
11. Work autonomously.
12. Work cooperatively.
13. Work in an organised manner.

Content

1. Complex numbers.

1.1 Trigonometric functions. Addition formulae. Identities. Trigonometric inverse functions.

1.2 Trigonometric equations.

1.3 Complex numbers. Sum, product and the invers. Square roots. Second degree equations.

1.4 Module and argument. Euler's formula.

1.5 Polynomials, roots and factorization. Fundamental theorem of Algebra.

2. Continuity

2.1 Continuity and limits.

2.2. Fundamental theorems of continuous functions. Exponential and logarithmic functions.

3. Differential calculus.

3.1 Derivatives of functions. Algebraic rules of derivation. Chain rule. Derived of the inverse.

3.2 Mean value theorem and consequences. Intervals of monotony.

3.3 Relative and absolute extremes. Optimization.

3.4 Calculation of limits using derivation.

3.5 Taylor's formula.

4. Integral Calculus.

4.1 Notion of Riemann integral.

4.2 Fundamental Theorem of Calculus. Barrow's theorem.

4.3 Calculation of primitives.

4.4 Applications of integrals.

5. Differential equations.

5.1 Notion of differential equation.

5.2 Solving the equations of separate variables.

5.3 First order linear equations.

5.4 Second order linear with constant coefficients.

5.5 Examples of applications of the differential equations.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Theoretical classes and exercise classes	45	1.8	1, 2, 10
Type: Supervised			
Supervised special sessions	24	0.96	1, 2, 10
Type: Autonomous			
Personal work	76	3.04	5, 6, 9, 10, 11

The subject has two hours of theory per week. They will be taught in the traditional way with a blackboard. The theory teacher will give the main ideas about the various topics by showing examples and exercises.

The student will receive lists of exercises and problems that we will work on in the weekly problem class. Previously, during your off-site activity, you will have read and thought about the proposed exercises and problems. In this way, their participation in the classroom can be guaranteed and the assimilation of procedural content will be facilitated.

Throughout the semester, there will be 5 seminar sessions (the last one is assessed) devoted to subjects of independent interest but related to the contents of the course.

The Virtual Campus will be the means of communication between teachers and students. It will be important to consult it every day.

The students will have a tutoring and counseling service both online and in the office. It is recommended to use this aid for monitoring the course.

Note: 15 minutes of a class will be set aside, within the calendar established by center/degree, for students to complete the teacher evaluation and subject/module evaluation surveys.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Evaluation of seminars	15%	1	0.04	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Midterm Exam 1	40%	2	0.08	1, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13
Midterm Exam 2	45%	2	0.08	1, 4, 6, 10

In order to avoid possible confusions and errors of legal interpretation, see the Catalan version.

Bibliography

1. F. Carreras, M. Dalmau, F. J. Albéniz, J. M. Moreno, Ecuaciones diferenciales, Ed. UAB, 1994.
2. N. Levinson i R. M. Redheer, Curso de variable compleja (Capítol 1) Ed. Reverté, 1981.
3. D. Pestana, J. Rodríguez, E. Romera, E. Touris, V. Álvarez, A. Portilla. Curso Práctico de Cálculo y Precálculo, Ed. Ariel, 2000.
4. S.L. Salas, E. Hille, Calculus Vol. 1, Ed. Reverté, 2002.
5. D. G. Zill, Ecuaciones Diferenciales con aplicaciones de modelado (6a ed.), International Thomson cop., 1997.

Software

There are no computer practice classes in the subject, so no study of computer programs will be done. Despite this, it will be recommended to use mathematical manipulation programs such as Maxima or Wolfram Alpha.

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	311	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	312	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	331	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	332	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	351	Catalan	first semester	afternoon
(PAUL) Classroom practices	352	Catalan	first semester	afternoon
(SEM) Seminars	311	Catalan	first semester	morning-mixed
(SEM) Seminars	312	Catalan	first semester	morning-mixed
(SEM) Seminars	313	Catalan	first semester	morning-mixed
(SEM) Seminars	314	Catalan	first semester	morning-mixed
(SEM) Seminars	315	Catalan	first semester	morning-mixed
(SEM) Seminars	316	Catalan	first semester	morning-mixed
(SEM) Seminars	317	Catalan	first semester	morning-mixed
(SEM) Seminars	318	Catalan	first semester	morning-mixed
(SEM) Seminars	319	Catalan	first semester	afternoon
(SEM) Seminars	320	Catalan	first semester	afternoon
(SEM) Seminars	321	Catalan	first semester	afternoon
(SEM) Seminars	322	Catalan	first semester	afternoon
(TE) Theory	31	Catalan	first semester	morning-mixed
(TE) Theory	33	Catalan	first semester	morning-mixed
(TE) Theory	35	Catalan	first semester	afternoon