Universitat Autònoma de Barcelona

2022/2023

Calculus

Code: 103796
ECTS Credits: 6

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

Contact

Name: Joan Josep Carmona Domènech
Email: joanjosep.carmona@uab.cat

Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Juan Jesús Donaire Benito
Joan Torregrosa Arus
Pol Orobitg Bernades
Gil Solanes Farres

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 very useful for them if they already have consolidated knowledge of Calculus that is taught in Baccalaureate: limits, continuity and derivability of real functions of a real variable; notions of integral calculus.

Objectives and Contextualisation

Achieve sufficient level in calculus of a variable to deal with phenomena and solve mathematical problems posed in engineering that can be described in these terms.

To sustain 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.

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 (part in seminars).

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.

Methodology

The subject has two hours of theory per week. They will be taught in the traditional way with a blackboard. The teacher in the theory will give the main ideas on the various topics 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 non-contact 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 the procedural contents will be facilitated.

Throughout the semester there will be 5 seminar sessions in which the student will have to solve and deliver problems similar to those that have been done in the problem classes. This year will be 10 groups of seminars, that will be mor useful for the sturdents.

The student will receive lists of exercises and problems that we will work on in the weekly problem class. Previously, during your non-contact 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 the procedural contents will be facilitated.

In the event that we are forced to teach electronically, sufficient material will be provided for monitoring. The Virtual Campus will be the means of communication between teachers and students. It will be important to consult it on a daily basis.

Students will have a tutoring and advice service both online and in the office. It is recommended to use this help for the follow-up of the course.

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.

Activities

Title	Hours	ECTS	Learning Outcomes

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

Assessment

Learning math is a complex process. Maturation is needed that is achieved throughout the course. Many times, some result from the beginning of the theory is understood to be completely advanced in the course. This shows the difficulty of the evaluations.

In the university there is the model of continuous assessment which is not viable as it is done in secondary education as there is neither the logistics nor the possibilities to carry it out. Then a model is made, which has a certain resemblance to a continuous assessment, and which forces the students to do the study we can say every day.

Competences will be assessed by means of two written exams, P1 and P2 on the theoretical concepts taught in theory and problem classes. The P1 exam will have an overall weight of 40% of the final grade and P2 an overall weight of 45%. There will also be a final S assessment on the seminar material with an overall weight of 15% of the grade. This activity will not be recoverable. To pass the subject in part will require:

1. Obtain a minimum grade of 2 in each of the partial tests.

2. QC = P1 * 0.40 + P2 * 0.45 + S * 0.15 $\geq$ 5

In the event that QC does not reach 5, the student will be able to take a second exam for each part where he will be able to obtain R1 and R2 grades, respectively. In ordre to have the possibiliyy to go to this second exam it must have obtain in the corresponding partial a minum grade of 0.5. Students who want to improve their grade by part will also be able to choose.

QF = max {P1, R1} * 0.40 + max {P2, R2} * 0.45 + S * 0.15.

To pass R1 and R2 must exceed 2.5.

The dates and deadlines of the evaluation activities will be set, sufficiently in advance and as appropriate, by the Degree Coordination orby the teacher responsible for the subject. Those convened by the teaching staff will be announced on the Virtual Campus

For each assessment activity, a place, date and time of review will be indicated in which the student will be able to review the activity with the teacher. In this context, claims may be made on the grade of the activity, which will be evaluated by the teacher responsible for the subject. If the student does not appear for this review, this activity will not be reviewed later.

These assessment conditions will be the same for all students enrolled in the subject, regardless of whether they are first-year students or if they have already enrolled in previous courses.

Without prejudice to other disciplinary measures deemed appropriate, and in accordance with current academic regulations, irregularities committed by a student that may lead to a variation in the grade will be graded with a zero (0). For example, plagiarizing, copying, copying, having communication devices (such as cell phones, smart watches, etc.) in an assessment activity will involve suspending that assessment activity with a zero (0). Assessment activities qualified in this way and by this procedure will not be recoverable. If it is necessary to pass any of these assessment activities to pass the course, this course will be suspended

directly, without the opportunity to retake it in the same course. The numerical mark of the transcript will be the lower value between 3.0 and the weighted average of the marks in case the student has committed irregularities in an act of evaluation (and therefore it will not be possible to pass it by compensation).

Assessment Activities

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

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, which can be very useful.