UAB
Universitat Autònoma de Barcelona

Calculus

Code: 103802
ECTS Credits: 6

2025/2026

Degree	Type	Year
Computer Engineering	FB	1

Contact

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Teachers

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Teaching groups languages

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

Prerequisites

There are no official prerequisites. However, it is essential that students have a very good command of the most basic concepts of mathematics. They must have a solid understanding of the calculus taught in upper secondary school. This includes limits, continuity and derivability of real functions of a real variable. It also includes concepts of integral calculus. These concepts will enable them to pass the PAU mathematics exam without any problems. Students without a minimum background in mathematics will need to work hard to address these deficiencies.

Objectives and Contextualisation

Solve mathematical problems that may arise in computer engineering.

Understand and work intuitively, geometrically and formally with the concepts of limits, continuity, derivatives and integrals.

Understand several methods for approximating functions.

Understand the construction of integrals, the calculation of integrals and their application to solving problems where integrals are necessary.

Understand methods for solving linear differential equations and their applications in engineering.

Learning Outcomes

1. CM02 (Competence) Integrate mathematical models and tools into problems that require an IT solution.
2. KM02 (Knowledge) Explain algorithmic procedures related to mathematical models and tools.
3. SM03 (Skill) Apply calculus knowledge to solve general computer engineering problems.
4. SM05 (Skill) Analyse the algorithmic needs of mathematical models for solving science and engineering problems.

Content

1.- Differential calculus.

Continuity. Bolzano's theorem and the maximum principle.
Mean value theorem, Rolle's theorem. Relative extrema and absolute extrema.
Successive derivatives. Concavity and convexity.
Graphical representation of functions.
L'Hôpital's rule.

2. Approximation of functions.

Taylor's formula.
Polynomial approximation.
Zeros of functions. Newton's method.

3.- Integral calculus.
The Riemann integral: definition and basic properties.
Calculation of primitives: integration by parts and changes of variables. Primitives of rational functions: decomposition into simple fractions. Primitives of trigonometric functions.
The Fundamental Theorem of Calculus.
Applications of the integral: Calculation of plane areas, curve lengths, volumes and areas of bodies of revolution.
Numerical integration. Trapezoidal method and Simpson's method.

4.- Differential equations.
Notion of differential equation and solution of a differential equation.
First-order differential equations that can be solved in an elementary manner. Second-order linear differential equations with constant coefficients. Applications.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical classes	19	0.76	
Theoretical classes	32	1.28	
Type: Supervised			
Student-teacher tutorials and consultations	16	0.64	
Type: Autonomous			

Exam preparation	15	0.6
Personal work	61	2.44

The theory teacher will present the main ideas on various topics. Students will receive lists of exercises. They will attempt to solve them. During their non-classroom activities, they will read and work on the proposed exercises and problems, as well as the necessary theoretical concepts. This will ensure their participation in class and help them to understand the procedural content. Throughout the semester, there will be four or five special sessions (seminars), during which students will solve and discuss problems similar to those covered in the problem-solving classes.

The virtual campus will be the main means of communication for the course, along with virtual teaching methods. We recommend using the institutional email addresses of the teachers listed in this guide. Students who wish to communicate with teachers by email must do so from the institutional email address provided by the university (@autonoma.cat). Naturally, students will have tutorial hours that will be established by the teaching staff.

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
Delivery 1	10%	1.5	0.06	CM02, SM05
Delivery 2	10%	1.5	0.06	CM02, SM05
Midterm Exam 1	40%	2	0.08	CM02, KM02, SM03
Midterm Exam 2	40%	2	0.08	KM02, SM03

During the course, there will be five seminar sessions (guided problem solving), two of which will be assessed (exercises will be handed in individually or in pairs). The marks for these exercises will account for 20% of the final mark. This part of the mark cannot be recovered.

There will be an exam (First Midterm = P_1) before the middle of the semester, which will assess the work done up to that point (corresponding approximately to the first two topics). The grade for this exam will account for 40% of the final grade. All students who take this exam will no longer be able to be graded as NOT ASSESSABLE. Students who do not take this exam will be recorded as NOT ASSESSABLE for academic purposes and will not be entitled to retake it (except for duly justified reasons, in which case they will be allowed to take the retake exam).

At the end of the semester, there will be a second midterm exam (which we call P_2) in which knowledge of topics 3 and 4 (approximately) will be assessed. The grade for this exam will contribute another 40% to the final grade. Students who do not take this exam will not be entitled to retake it (except for duly justified reasons, in which case they will be allowed to take the retake exam).
Grading:
If the average of the marks (out of 10) of the two midterms M=(P_1+P_2)/2 is less than 2.5, the student has failed the course, with a final mark of M, without the right to take the resit exam.

If M is greater than 2.5 but less than or equal to 3.5, the student must take the resit exam.
If M is greater than or equal to 3.5, then if NF=0.8 M+ 0.2 S (where S is the average grade for the seminars, out of 10) is greater than or equal to 5, the student has passed and has NF as their final grade; otherwise, they must take the resit exam.
If the student has to take the resit exam, then if the resit grade R is less than 3.5, the student has failed with a final grade of R; if R is greater than or equal to 3.5, the final grade will be min(0.8 R + 0.4 S,7) where R is the resit exam grade (out of 10).
The use of calculators in mid-term and resit exams will be announced a few days before each exam via the virtual campus.

The 5% of highest marks will be awarded a grade of Matrícula de Honor (Honours) provided that: the mark for each midterm exam is not less than 9 and the NF mark described above exceeds 9.4. These assessment conditions will be the same for all students enrolled in the course, regardless of whether they are first-time enrolments or have already enrolled in previous courses. The final decision on the MH grade will be made by the teaching staff.

For each assessment activity, a place, date and time will be indicated for the student to review the activity with the teaching staff. In this context, complaints about the activity grade may be made, which will be evaluated by the teaching staff responsible for the course. If the student does not attend this review, the activity will not be reviewed at a later date. The dates for the submission of problems and mid-term exams will be published on the Virtual Campus (VC) and may be subject to possible changes in scheduling due to adaptation to possible incidents; the VC will always be informed of these changes, as it is understood that the VC is the usual mechanism for the exchange of information between teachers and students.

In this course, the use of Artificial Intelligence (AI) technologies is not permitted in any of its phases. Any work that includes fragments generated with AI will be considered a breach of academic honesty and may result in a partial or total penalty in the activity grade, or greater penalties in serious cases.
Without prejudice to other disciplinary measures deemed appropriate and in accordance with current academic regulations, any irregularities committed by a student that may lead to a change in the grade will be graded with a zero (0). For example, plagiarism, copying, allowing others to copy, or having communication devices (such as mobile phones,smart watches, etc.) during an assessment activity will result in the suspension of this assessment activity with a zero (0). Assessment activities graded in this way and by this procedure will not be recoverable. If it is necessary to pass any of these assessment activities in order to pass the course, this course will be suspended directly, with no opportunity to recover it in the same academic year. The numerical grade on the transcript will be the lower value between 3.0 and the weighted average of the grades if the student has committed irregularities in an assessment (and therefore it will not be possible to pass by compensation).

The assessment of cross-curricular skills is integrated into the rubric (or marking scheme for problems) for mid-term exams. The score for the sections of the rubric corresponding to cross-curricular skills is worth between 5% and 10% of the score for the corresponding problem.

This subject does not use a single assessment system.

This English version of the guide is a translation of the original Catalan text. In the event of any discrepancy between the two, the Catalan version is the definitive version.

Bibliography

- S.L. Salas, E. Hille 'Calculus' Vol. 1, Ed. Reverté, 2002.
- D.G. Zill 'Ecuaciones diferenciales con aplicaciones de modelado' International Thomson, 1997.
- F. Carreras, M. Dalmau, F.J.M. Albéniz, J.M. Moreno 'Ecuaciones diferenciales' Ed. Dept. de Matemàtiques, 1987.
- Notes de Càlcull, Miquel Llabrés

Software

No program will be used

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	411	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	412	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	431	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	432	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	451	Catalan	first semester	afternoon
(SEM) Seminars	411	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	412	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	431	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	432	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	451	Catalan/Spanish	first semester	afternoon
(SEM) Seminars	452	Catalan/Spanish	first semester	afternoon
(TE) Theory	41	Catalan	first semester	morning-mixed
(TE) Theory	43	Catalan	first semester	morning-mixed
(TE) Theory	45	Catalan	first semester	afternoon