Universitat Autònoma de Barcelona

2021/2022

Calculus

Code: 103802
ECTS Credits: 6

Degree	Type	Year	Semester
2502441 Computer Engineering	FB	1	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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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

Josep Maria Burgués Badía
Armengol Gasull Embid
Joan Orobitg Huguet
Joan Verdera Melenchón
Juan Eugenio Mateu Bennassar
Yamila Garcia Martinez
Juan Pablo Roberto Márquez Arias

Prerequisites

Although there are no official prerequisites, it is recommended that students have consolidated the knowledge of the Calculus taught in high school: limits, continuity and derivability of real functions of a real variable, notions of integral calculus and trigonometry.

Objectives and Contextualisation

Solve the mathematical problems that can arise in computer engineering.

Know and work intuitively, geometrically and formally the notions of limit, continuity, derivative and integral.

Know the construction of the integral, the calculation of integrals and its application to solving problems where the integral approach is necessary.

Know the methods of solving linear differential equations.

Competences

- Acquire personal work habits.
- Acquire thinking habits.
- Have the capacity to resolve the mathematical problems that can arise in engineering. Have the aptitude to apply knowledge about: linear algebra, differential and integral calculus, numerical methods, numerical algorithms, statistics and optimisation.
- Know the basic materials and technologies to enable the learning and development of new methods and technologies, as well as those that that provide large-scale versatility to adapt to new situations.

Learning Outcomes

1. Develop a capacity for analysis, synthesis and prospection.
2. Know and apply the mathematical methods of deduction and demonstration.
3. Prevent and solve problems.
4. Recognise and identify the mathematical models of an engineering problem.
5. Show capacity to deal with complex numerals and the application of differential and integral calculus.

Content

1.- Functions of a real variable.
Basic concepts of functions. Elementary functions: trigonometric, exponential and logarithmic. Continuity.

2.- Differential calculus.
Mean value theorem, growth intervals, relative extremes and absolute extremes.
Hôpital rules. Successive derivatives.
Concavity and convexity.
Graphical representation of functions.

3.- Comprehensive calculation.
The Riemann integral: definition and basic properties.
The Fundamental Theorem of Calculus.
Calculation of primitives: integration by parts and changes of variables. Primitives of rational functions: decomposition into simple fractions. Primitives of trigonometric functions.
Applications of the integral: Calculation of flat areas, lengths of curves, volumes and areas of bodies of revolution.

4.- Differential equations.
Notion of differential equation and solution of a differential equation.
First order differential equations resolvable in elementary form. Differential linear equations of higher order with constant coefficients.

Methodology

The theory teacher will give the main ideas on the various subjects. The student must solve the proposed problems. The teacher of problems will solve the doubts that are put to him and will propose methods of solution. Throughout the semester there will be four special sessions (seminars) in which the student will have to solve and deliver problems similar to those that have been made in the problem classes.

Transversal Competences:

T01.02 - Develop the capacity for analysis, synthesis and prospective: we work in all kinds of theory and problems since critical reasoning and the ability to analyze and synthesize are fundamental in the development of the subject. The evaluation of this competence is done in all tests and examinations which are corrected mitjaçant a rubric that takes it into consideration.
T02.04 - Prevent and solve problems: we mainly work in the seminar sessions and their evaluation is done from the exercises that are delivered in these sessions.

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			
Practical classes	19	0.76	2, 5, 1, 3, 4
Theoretical classes	32	1.28	2, 5, 1, 4
Type: Supervised			
Student-teacher tutorials and consultations	16	0.64	5, 1, 3, 4
Type: Autonomous			
Exam preparation	15	0.6	2, 1, 4
Personal work	60	2.4	2, 5, 1, 4

Assessment

During the course there will be 5 sessions (of problems or seminars). In 3 of them exercises will be delivered individually or in pairs and will be graded. The grades of these exercises represent 30% of the final grade. This part of the grade will not be recoverable.

There will be an exam (First Midterm = P 1) before half a semester in which the work done up to that moment will be evaluated (corresponds approximately to the first two topics). The mark of this exam will provide 35% of the final grade. All students who take this exam can no longer be classified as NOT EVALUABLE. Any student who has not taken this exam will be considered NOT EVALUABLE for academic purposes and will not be entitled to recover it (except for duly justified cause, in which case the recovery exam will be allowed).

At the end of the semester there will be a second midterm exam (which we call P_2) in which the knowledge of topics 3 and 4 (approximately) will be evaluated. The mark of this exam will provide another 35% of the final grade. Any student who has not taken this exam will not have the right to recover it (except for duly justified cause, in which case the recovery exam will be allowed).

If the average of the marks (out of 10) of the two midterms (P 1 + P_2) / 2 is less than 3 the student must go to the recovery exam, which is a global exam of the whole subject. If the mean M = (P 1 + P_2) / 2 is greater than or equal to 3, then the final grade is NF = 0.7 M + 0.3 S, where S is the average grade of the seminars (out of 10) . If NF is higher than 5 the student has approved and has NF as a final grade. If not, the student must go to the recovery exam and in this case the final grade will be 0.7 R+ 0.3 S, where R is the grade of the recovery test (out of 10).

In the midterm exams and in the recovery exam will not be allowed to use calculator.

The 5% of the highest grades may be graded with an Honor's Certificate provided that: the grade of each partial is not less than 9 and the NF grade described above exceeds 9.4. These evaluation conditions will be the same for all students enrolled in the subject, regardless of whether they are enrolled first or if they had already enrolled in previous courses. The final decision on the qualification of MH will be taken by the teachers.

For each evaluation activity, a place, date and time of revision in which the student can review the activity with the faculty will be indicated. In this context, claims may be made on the activity grade, which will be evaluated by the faculty responsible for the subject. If the student does not appear in this review, this activity will not be

reviewed later. The dates of the delivery of problems and the partial exams will be published in the Virtual Campus (CV) and may be subject to possible programming changes for reasons of adaptation to possible incidents; The CV will always be informed about these changes since it is understood that the CV is the usual mechanism of exchange of information between teacher and students.

Without prejudice to other disciplinary measures considered appropriate and in accordance with current academic regulations, irregularities committed by a student that may lead to a variation of the grade will be scored with a zero (0). For example, plagiarizing, copying, copying, having communication devices (such as mobile phones, smart watches, etc.) in an evaluation activity will imply suspending this evaluation activity with a zero (0). The evaluation activities qualified in this way and by this procedure will not be recoverable. If it is necessary to pass qualification and evaluation activities to pass the subject, this subject will be suspended directly,with no opportunity torecover it in the same course. The numerical note of the file will be the lower value between 3.0 and the weighted average of the marks in case the student has committed irregularities in an evaluation act (and therefore the approved by compensation will not be possible). The evaluation of transversal competences is integrated in the rubric (or problem correction guideline) of the partial exams. The score of the sections of the rubric corresponding to transversal competences has a value of between 5% and 10% of the score of the corresponding problem.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Delivery 1	10%	2	0.08	2, 1, 3
Delivery 2	10%	1	0.04	2, 1, 3, 4
Delivery 3	10%	1	0.04	2, 5, 3, 4
Midterm Exam 1	35%	2	0.08	2, 5, 1, 4
Midterm Exam 2	35%	2	0.08	2, 5, 1, 4

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