Universitat Autònoma de Barcelona

2022/2023

Calculus

Code: 103815
ECTS Credits: 9

Degree	Type	Year	Semester
2501233 Aeronautical Management	FB	1	A

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

Joan Josep Carmona Domènech
Inna Basak Gancheva
Alan Morte Piferrer

Prerequisites

This subject does not have specific prerequisites and should not present special difficulty for people who have taken the Scientific Baccalaureate and have passed the selectivity tests. But experience shows us that people who have not done the training in high school mathematics or power many years ago who took it many years ago and their knowledge in mathematics is very meager. These people find it very difficult to follow the course. They are people who can make a derivative of a rational function well, but then simplify diagonally and match from here it no longer makes sense anything they do below. Or apply to the principle that the square root of a difference is difference of square roots and the whole problem loses meaning. These people need to be aware of their problems and take action. For example, they can review high school books, or take a private class, talk to the teacher, ask a classmate for help, and so on.

In particular on these points they should have no doubts.

1. Calculation with rational numbers, fractions, both percent and real numbers.

2. Calculation of algebraic expressions with letters and numbers, simplifications.

3. Solving first and second degree polynomial equations. Integer division of polynomials.

4 Clear notions of trigonometry and equations of straight lines in the plane.

Objectives and Contextualisation

The subjects of Calculus, Statistics and Linear Algebra form a block that is designed within the Curriculum to provide students with the concepts and mathematical tools necessary to understand, develop and evaluate the

management processes of the different systems present in the sector. aeronautical. The aim is also to provide students with a mastery of basic mathematical language so that they can later tackle the reading of texts that they may need, both academically and professionally.

In this subject it is necessary for the student to become familiar with the functions of a variable and to have some initial notions of functions of two or three real variables. Some cross-curricular goals must also be achieved, mainly developing the ability to translate real-life problems into mathematical language, pose them and solve them correctly.

Competences

- Personal attitude.
- Personal work habits.
- Thinking skills.
- Use knowledge of the fundamental principles of mathematics, economics, information technologies and psychology of organisations and work to understand, develop and evaluate the management processes of the different systems in the aeronautical sector.

Learning Outcomes

1. Critically assess the work done.
2. Derive functions and perceive derivatives as reasons for change.
3. Develop critical thought and reasoning.
4. Develop curiosity and creativity.
5. Develop independent learning strategies.
6. Develop scientific thinking skills.
7. Develop systemic thinking.
8. Develop the ability to analyse, synthesise and plan ahead.
9. Draw and interpret graphs of functions.
10. Formulate and solve problems that require solutions to differential equations.
11. Manage time and available resources. Work in an organised manner.
12. Optimise functions of one or several variables.
13. Use basic mathematical language to understand the texts that use it.
14. Work independently.

Content

1. Functions of a real variable

1.1 Real numbers, intervals, equations, inequations. Functions, composition of functions and graphics.

1.2 Limits of functions. Continuity. Bolzano's theorem. Theorem of existence of absolut extrems.

1.3 Polynomial functions. Exponential and logarithms. Trigonometric functions

1.4 Derivation of functions. Algebraic rules of derivation. Rule of the chain. Derived of the inverse function.

1.5 Mean value theorem. Growth of functions. Relative and absolute extremes. Calculation of limits with derivation techniques.

1.6 Concavity and convexity of functions. Graphical representation of functions.

1.7 Optimization problems.

2 Integral Calculus

2.1 Integral defined. Properties of the integrals.

2.2 Fundamental theorem of Integral Calculus. Barrow's theorem.

2.3 Calculation of primitives.

2.4 Applications of the defined integrals.

2.5 Notion of differential equation. Explicit resolution of some first-order differential equations.

2.6 Some applications of differential equations.

3. Functions of several real variables

3.1 Plane and space vectors. Coordinates

3.2 Scalar product.. Distances.

3.3 Functions of several variables. Level sets.

3.4 Directional and partial derivatives. Gradient Rule of the chain. Plan tangent to a surface.

3.5 Free extremes of functions of two real variables

Methodology

This is an annual subject. In the first semester there are two hours of theory per week, one of problems per week and two seminars. In the second semester there is a weekly hour of theory, a weekly hour of problems and a seminar. In the current forecasts regarding the Covid-19 pandemic it seems that classes will be able to be done in person.

The own language and the contents of the subjects of mathematics can make difficult the individual work of the student, for that reason it is essential to make the most of the theoretical explanations, the practical classes and the tutorial hours.

The theoretical classes, if they can finally be done in person, will be presented in the traditional way, ie slate and plaster. Theoretical classes will serve to introduce the basic concepts, clarify ideas and provide the tools to successfully deal with problem solving. Theoretical classes will constantly include examples and problems that help illustrate theoretical concepts. In the problem classes there will be the exercises of the lists that will be provided by the teachers of the subject. It is highly recommended that the student has previously read and worked on the exercises proposed in the lists. In this way, participation in problem classes and content assimilation will be more profitable. By having only one hour a week of problems, the most representative problems that serve as a model for others will be shown in the classroom.

As for the seminars, three seminar sessions are planned. In the first hour of each one, questions and problems will be proposed that the students will have to solve, and they will be able to work in groups. A second handout with similar questions will be handed out to the teacher and will be assessed. They can do it in work groups of two people.

In anticipation of the impossibility of conducting classes in the classroom, the Moodle classroom within the Virtual Campus will be of vital importance. This will be the most important channel of communication between students and teachers. There will be plenty of material to follow the course. In the case of not being able to take a class, there you will find the study aid material for the class time to be taught. It will be important to consult the Virtual Campus very frequently.

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			
Classes of problems	22	0.88	1, 2, 6, 7, 5, 8, 4, 3, 9, 13, 11, 12, 10, 14
Classes of theory	45	1.8	2, 6, 7, 8, 3, 9, 13, 12, 10
Seminars	6	0.24	1, 2, 6, 7, 5, 8, 4, 3, 9, 13, 11, 12, 10, 14
Type: Autonomous			
Learning the basic concepts	50	2	1, 2, 6, 7, 5, 8, 4, 3, 9, 11, 12, 10, 14
Preparation to be evaluated	23	0.92	1, 2, 6, 7, 5, 8, 4, 3, 9, 13, 11, 12, 10, 14
Solving problems	67	2.68	1, 2, 6, 7, 5, 8, 4, 3, 9, 13, 11, 12, 10, 14

Assessment

a) Scheduled evaluation process and activities

Activity P1, consisting of a partial exam at the end of the first semester, with a weight of 40% on the final grade.

Activity P2, consisting of a partial exam at the end of the second semester, with a weight of 30% on the final grade.

Activity C1, consisting of a test of problems in the middle of the first term, with a weight of 10% on the final grade.

Activity C2, consisting of a problem test in the middle of the second semester, with a weight of 10% on the final grade.

Activity S, attendance at seminars and delivery of work done during the three seminars, 10% on the final grade.

Each of these evaluable activities will receive a grade between 0 and 10 and we will denote it by P1, P2, C1, C2, S1, S2, S3 respectively.

In order to pass the course, through continuous assessment, it will be necessary to have a minimum {P1, P2} greater than or equal to 0.5.

The qualification of the continuous evaluation will be:

QC = 0.40 * P1 + 0.10 * C1 + 0.30 * P2 +0.10 * C2 + 0.04 * S1 + 0.03 * S2 + 0.03 * S3

Please note that activities C1, C2 and S are not recoverable and their dates are set at the beginning and will be non-removable. In the event of the impossibility of a student attending the session convened, with a documented justified cause, the solution to the problem that has been raised will be sought individually.

b) Programming of evaluation activity

The calendar of assessment activities will be made public through the Virtual Campus and the dates and classrooms of the two partial exams on the website of the School of Engineering, in the exams section.

c) Recovery process

A two-part recovery exam will be scheduled:

- R1 will be the qualification of the recovery of the activity P1, on the syllabus of the first term

- R2 will be the qualification of the recovery of the activity P2, on the syllabus of the second semester

In order to take the resit test, the student must meet two conditions. The first to have presented in both partials and to have a minimum {P1, P2} greater than or equal to 0.5 and the second that the QC qualification must be greater than or equal to 1.3.

Students who, having fulfilled the two previous conditions, have obtained a mark inferior to 1 in some of the activities P1 or P2, will have to do the recovery R1 or R2 according to the case. Students who, having obtained a grade equal to or higher than 1 in activities P1 and P2, do not pass with the continuous assessment may choose whether to appear in part R1 of the recovery or in part R2 or both.

The final grade will be obtained with the following formula:

QF = 0.40 * maximum {P1, R1} + 0.10 * C1 + 0.30 * maximum {P2, R2} + 0.10 * C2 + 0.04 * S1 + 0.03 * S2 + 0, 03 * S3

Students who have obtained a QC grade greater than or equal to 5 and want to improve it will also be able to take the recovery, under the same conditions. For these students the same QF formula will be applied.

d) Procedure for reviewing grades

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.

e) Qualifications

Honors registrations. Granting an honorary enrollment grade is the decision of the teacher responsible for the subject. UAB regulations state that MHs can only be awarded to students who have obtained a final grade equal to or higher than 9.00. Up to 5% MH of the total number of students enrolled can be awarded.

A student will be considered non-assessable (NA) if he or she has failed neither the first midterm nor the second midterm.

f) Irregularities on the part of the student, copying and plagiarism.

Without prejudice to other disciplinary measures deemed appropriate, irregularities committed by the student that may lead to a variation in the grade of an assessment act will be graded with a zero. Therefore, copying, plagiarism, cheating, copying, etc., partially or completely in any of the evaluation activities will involve suspending it with a zero. The implications that this assessment has in the possibility of passing the subject will be assessed by the teaching staff having spoken with the people involved.

h) Evaluation of repeating students

The repeating student will be required to follow the general continuous assessment procedure specified in the previous points. Students for whom it is their last call must notify the theory teacher at the beginning of the course.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Partial examination of the content of first semester	40	3	0.12	1, 2, 6, 7, 5, 8, 4, 3, 9, 13, 11, 12, 10, 14
Partial examination of the content of second	30	3	0.12	1, 2, 6, 7, 5, 8, 4, 3, 9, 13, 11, 12,

semester				10, 14
Seminars	10	3	0.12	1, 2, 6, 7, 5, 8, 4, 3, 9, 11, 12, 10
Solving problems	20	3	0.12	1, 2, 6, 7, 5, 8, 4, 3, 9, 13, 11, 12, 10, 14

Bibliography

The program of the subject is covered in many books. To sample example:

- LARSON, HOSTETLER, EDWARDS ; Cálculo. Vol. 1,2. Piràmide.2002.
- THOMAS, FINNEY; Cálculo con Geometría Analítica. Vol. 1, 2. Addison Wesley Iberoamericana. 1987.
- SALAS, HILLE; Calculus, Vol. 1,2. Reverté. 1995.
- DEMIDOVICH; Problemas y ejercicios de Anàlisis Matemático. Paraninfo. 1993.

All these books and many others similars can be found at the Biblioteca de Sabadell. It is recommended that you visit this library and make regular use of its funds.

We will also put some notes of the course available to students in Campus Virtual system.

Software

There are no computer internship classes planned in the course, 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. Both of these programs are free to use, although the latter has a paid version that is not expensive.