Foundations of Mathematics

Code: 104342
ECTS Credits: 6

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Degree	Type	Year
2503758 Data Engineering	FB	1

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Teaching groups languages

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

Prerequisites

The subject has no official prerequisites. Due to its content, it should be easily assimilated by students who have a good scientific baccalaureate education and have passed the selectivity. Much of the content will coincide with high school topics, except for the last two chapters.

If a person finds that he has difficulty in following the course because he notices that he lacks the foundation, he should do a review using books from his high school.

Objectives and Contextualisation

This subject must be used to consolidate basic knowledge of Calculus that will be necessary to address, in higher courses, other more specialized subjects of the Data Engineering Degree. There is a special emphasis on the use of all these tools in data processing.

Competences

- Demonstrate sensitivity towards ethical, social and environmental topics.
- Make a critical evaluation of work carried out.
- Search, select and manage information and knowledge responsibly.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.

- Use the concepts and methods of algebra, differential and integral calculus, numerical methods, statistics and optimisation necessary for solving engineering problems.

Learning Outcomes

1. Demonstrate sensitivity towards ethical, social and environmental topics.
2. Identify and apply the basic theorems of the continuous functions of a variable.
3. Identify when differential and integral calculus is needed.
4. Make a critical evaluation of work carried out.
5. Perform derivatives, partial derivatives and integrals.
6. Search, select and manage information and knowledge responsibly.
7. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.

Content

1. Funcions de variable real.

1.1 Nombres reals. Successions de nombres reals. Càlcul de límits. Equacions i inequacions.

1.2 Funcions d'una variable. Límits i continuïtat. Teoremes principals.

1.3 Derivació. Regles de derivació. Extrems absoluts i relatius.

1.4. Concavitat i convexitat. Representació de funcions.

1.5. Fórmula de Taylor i aplicacions.

1.6. Zeros de funcions d'una variable. Mètode de Bisecció i Newton.

2 Integració de funcions d'una variable.

2.1. La integral definida. Propietats. Teorema fonamental del càlcul.

2.2. Primitiva d'una funció. Tècniques de càlcul de primitives: per parts i canvi de variable i integrals racionals.

2.3. Aplicacions del Càlcul Integral

3. Funcions de diverses variables.

3.1. Corbes i superfícies de nivell.

3.2. Continuïtat.

3.3. Derivades parcials. Funcions diferenciables. Regla de la cadena.

3.4. Gradients i derivades direccionals. Rectes i plans tangents-

3.5 Extrems relatius i absoluts.

3.6. Optimització. Mètode del gradient i de Lagrange.

4. Integració de funcions de dues o tres variables.

4.1. Integrals iterades. Teorema de Fubini.

4.2. Canvis de variable. Coordenades polars, cilíndriques i esfèriques.

En cadascun d'aquest temes es presentarà un resum teòric dels conceptes i les tècniques fonamentals i immediatament es passarà a treballar exemples d'aplicació d'aquests conceptes i tècniques en el tractament de dades.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Preparation of partial tests	15	0.6	
Problem Classes	24	0.96	1, 2, 3, 4, 5, 6, 7
Theory Classes	24	0.96	1, 2, 3, 4, 5, 6, 7
Type: Autonomous			
Resolution of problems and delivery of evaluable problems	37	1.48	2, 3, 4, 5, 6, 7
Theory study	25	1	

This subject is four-monthly and has hours of theory, problems and practice classes. Specifically, there are 26 to 30 hours of theory, 12 problems and 12 practice classes.

In view of the face-to-face hours, it becomes clear that in the learning process of this subject, the constant work of the student throughout the entire semester will be essential. You will have the help of the teaching team at all times and will have online tutoring and consultation times.

The face-to-face hours are distributed in:

Theory: The teacher introduces the basic concepts corresponding to the subject matter showing examples of their application, it will be done in the classroom using the traditional chalk and blackboard method. The student will have material in the Virtual Campus that will help him follow the explanations

Problems: The understanding of the concepts introduced in theory is worked on with the realization of problems and discussion of practical cases. The students will previously have lists of exercises on which they will work during the two hours a week of problem classes. Previously, during your off-site activity, you will have read and worked through 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. Given the few problem hours available, only model problems can be done in the problem class.

Practice: The student will learn to use the Sage Math program. The practice classes will be held in the computer rooms. In these classes, the application of mathematical tools to problems that require the use of a computer program will be worked on. The aim of this learning will be for the student to be able to use the computer to address (and be able to solve) any mathematical issue that they may need to consider in the future.

The teaching of the course will essentially use the VIRTUAL CAMPUS as a means of communication. It is recommended to use the teachers' institutional email, which is listed in this guide. Students who wish to communicate with teachers by email must do so from the institutional address provided by the university (@autonoma.cat). As is natural, the students will have tutoring hours (to be agreed) in the teachers' offices.

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
Group activities in problem classes	20% of the final note	6	0.24	1, 2, 3, 4, 5, 6, 7
Partial tests	60% of the final grade	4	0.16	2, 3, 5, 7
Two or three tests in class and/or problem delivery	20% final grade	15	0.6	2, 3, 4, 5, 6, 7

With the objective of avoiding possible translation errors of legal interpretation and also with the objective of facilitating the learning of the Catalan language for students who do not know it, it is advised that they look at the corresponding section of the guide in Catalan. If in doubt, ask your teachers, they will be happy to answer your questions.

Bibliography

Bibliografia bàsica

1. D. Pestana, J. Rodríguez, E. Romera, E. Touris, V. Alvarez, A. Portilla. Curso Práctico de Cálculo y Precálculo, Ed. Ariel, 2000.

2. S.L. Salas, E. Hille. Calculus Vol. 1, Ed. Reverte, 2002.

3. C. Neuhauser, Matemáticas para ciencias. 2a, edición Pearson, Prentice Hall.

4. J.M. Ortega, Introducció a l'Anàlisi Matemàtica. Manual UAB

Software

The free-to-use program Sage Math will be used in the practice classes. The student can use other free programs such as Maxima or Wolfram Alfa, all the programming knowledge they have will be useful in the future.

Language list

Name	Group	Language	Semester	Turn

(PAUL) Classroom practices	811	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	812	Catalan	first semester	morning-mixed
(TE) Theory	81	Catalan	first semester	morning-mixed