	2022/2023
Mathematics	
Code: 104521 ECTS Credits: 6	

Degree	Type	Year	Semester
2503743 Management of Smart and Sustainable Cities	FB	1	1

Contact

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Teachers

Montse Meneses Benitez

Use of Languages

Principal working language: spanish (spa)

Some groups entirely in English: No

Some groups entirely in Catalan: No

Some groups entirely in Spanish: No

Prerequisites

It is advisable to have studied Mathematics, whether scientific or social, in the Baccalaureate. If you have not, it is recommended to take the introductory course in mathematics offered by the University.

Objectives and Contextualisation

The aim of the Mathematics subject is to provide the student with the mathematical concepts and tools necessary to understand, develop and evaluate the processes of the systems present in a smart city.

Competences

- Analyse and model urban and regional dynamics using methodological instruments for qualitative and quantitative analysis.
- Critically analyse work carried out and demonstrate a desire to improve.
- Design platforms of management, integration of public and government services applying technologies and systems of sensorization, acquisition, processing and communication of data.
- Generate innovative and competitive proposals in professional activity.
- Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
- 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.
- Work cooperatively in complex and uncertain environments and with limited resources in a multidisciplinary context, assuming and respecting the role of the different members of the group.

Learning Outcomes

1. Analyse functions based on graph representation.

2. Calculate and study function endpoints.
3. Calculate function integrals for a variable.
4. Critically analyse work carried out and demonstrate a desire to improve.
5. Generate innovative and competitive proposals in professional activity.
6. Identify and use mathematical language and basic demonstration methods.
7. Identify situations characterized by the presence of randomness and analyse these using basic probabilistic tools.
8. Operate with matrices and calculate determinants.
9. Pose and analytically resolve optimization problems in the ambit of ??city management.
10. Solve problems in the ambit of ??city management through integrals.
11. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
12. 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.
13. Understand and work intuitively, geometrically and formally with notions of limit, derivatives and integrals.
14. Work cooperatively in complex and uncertain environments and with limited resources in a multidisciplinary context, assuming and respecting the role of the different members of the group.

Content

The contents of the subject are divided into four main blocks:

Block I. Differential and integral calculus.

Topic 1. Functions, continuity, limits, derivability.

Topic 2. Applications of the derivative: graphic representation and optimization.

Topic 3. Integration of functions and their applications.

Block II. Linear algebra

Topic 4. Systems of linear equations.

Block III. Descriptive statistics.

Topic 5. Introduction to descriptive statistics.

Block IV. Discrete Mathematics

Topic 6. Introduction to discrete mathematics.

Methodology

The activities that could not be done onsite will be adapted to an online format made available through the UAB's virtual tools.

The teaching methodology to follow is oriented to the learning of the subject by the student on a continuous basis. This process is based on the realization of three types of activities that will be developed throughout the course: theory classes, seminars of problems and practices with computer:

- Theoretical sessions: the teacher will provide information on the knowledge of the subject and on strategies to acquire, extend and organize this knowledge. Active participation of students during these sessions will be encouraged, for example by fostering discussions at those points that have a higher conceptual load.

- Problem seminars: students must participate actively to consolidate acquired knowledge by solving, presenting and debating problems that are related to them.

- Computerized practices: students will have to work on teams of several people in the resolution of mathematical problems by using computational tools. They will then have to present the obtained results through oral and written reports. The transversal competences T01, T03 and T05 will be evaluated in the computer practices by performing a critical analysis of the work done by each team member and the total presented work.

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			
Problem seminars	18	0.72	1, 2, 3, 13, 6, 7, 8, 9, 10
Theory lessons	26	1.04	1, 2, 3, 13, 6, 8, 9, 11, 10
Type: Supervised			
Computer practice	6	0.24	1, 4, 2, 3, 13, 5, 6, 8, 9, 10, 14
Type: Autonomous			
Problem solving	50	2	1, 2, 3, 13, 6, 7, 8, 9, 10
Study	42	1.68	1, 2, 3, 13, 6, 7, 8, 9, 12, 11, 10

Assessment

In the event that assessment activities cannot be taken onsite, they will be adapted to an online format made available through the UAB's virtual tools (original weighting will be maintained). Homework, activities and class participation will be carried out through forums, wikis and/or discussion on Teams, etc. Lecturers will ensure that students are able to access these virtual tools, or will offer them feasible alternatives.

The evaluation of the subject will be done in a progressive form and continued during all the semester. The system of evaluation bases in the following rules:

a) Process and activities of evaluation

The following activities are foreseen:

- ***Activity A. Realisation of test in the platform Moodle.*** The part of linear systems of equations will be studied in an autonomous form by students from material supplied by professors. Afterwards, the student will have to complete a test in Moodle in order to show the acquired knowledge. This activity sums up 5% on the final grade of the subject.
- ***Activity B. Presentation of reports, by writing and orally***, relative to the exercises solved with computer, worked during the course, with the aim to follow the evolution of each student in the understanding and use of the tools worked in the subject, and to improve at the same time the acquisition of transversal competitions. This activity sums up 15% on the final grade of the subject. The final grade of this activity will be the average of the grades obtained in each practice.
- ***Activity C. Examination of the contents of the Block I,*** to favour the consolidation of the group of the material worked during the course. This activity sums up 40% on the final grade of the subject.

- ***Activity D. Examination of the contents of the Blocks III and IV***, to favour the consolidation of the group of the material worked during the course. This activity sums up 40% on the final grade of the subject.

In order to pass the subject, it will be necessary to take out a minimum grade of *5* in the activities, *A, C* and *D*. It is necessary to bear in mind that the Activities A and *B* are "not recoverable". Therefore, not passing the activity A within the established deadline with a grade higher to the indicated previously (5), supposes not being able to approve the subject.

b) Schedule of evaluation activities

The schedule of evaluation activities will be given the first day of class and will be made public through the Virtual Campus (Moodle) and in the web of the School of Engineering, at the section of examinations. The following schedule is foreseen:

+ Activity A: to complete before the ending of the classes (December 23, 2022).

+ Activity B: it will be communicated during the first week of class.

+ Activity C: Examination block I (partial): 9 November 2022 . Final examination and Recovery: dates to determine by the School (January of 2023).

+ Activity D: Final Examination and Recovery: dates to determine by the School (January of 2023).

If the student passes the activity *C* (takes out more than or equal to 5) in the partial examination, frees this part of subject (activity approved) and only will have to present to the examination of the blocks III and IV (Activity *D*) in the date of the final examination (January of 2023). If the student does not approve the activity *C* in the partial examination, he/she will have to present to this examination (activity *C*) jointly with the activity *D* in the date of the final examination. To approve the activity *A* there will be available two possibilities along the semester.

c) Process of re-taking

For those students that at the end of the process of evaluation have not obtained an equal or higher qualification to 5 in the activities *C* and *D*, there will be a re-evaluation. This will consist in the realisation, in the planned date by the School, of an examination containing representative contents of the situations worked during the course. The students only will have to present to the examination of the activity that have not approved before. If a student does not arrive to the minimum grade of 5 in any of the activities *A, C* or *D* and by this reason does not approve the subject, the final grade will be of 4,5 at most, that is to say, the same to the value of the average grade if it is inferior to 4,5 or 4,5 if it is higher.

d) Procedure of review of the qualifications

For each evaluation activity, a place, date and hour of review will be indicated in which the student will be able to review the activity with the professor. In this context, he will be able to do claims on the grade of the activity, that will be evaluated by the professors responsible of the subject. If the student does not take part of this review, this activity will not be reviewed later.

e) Qualifications

The final grade of the subject will be calculated by using the weights mentioned in section a). It is necessary to take into account that:

- Grade "with honours". Award a qualification "with honours" is only decision of the professors responsible of the subject. The rule of the UAB indicates that the "with honours" grade only will be able to concede to students that have obtained an equal final qualification or higher to 9.00 and, as maximum, in a quantity not greater than 5% of the total enrollment.
- Non evaluable. It will be considered "non evaluable" a student that have not presented to any activity *C* or *D*. In any another case follow the criteria of evaluation detailed above.

f) Irregularities by part of the student, copy and plagiarism

Notwithstanding other disciplinary measures deemed appropriate, and in accordance with the academic regulations in force, assessment activities will receive a 0 score whenever a student commits academic irregularities that may alter such assessment. The assessment activities qualified in this way and by this procedure will not be recoverable. If you need to pass any of these assessment activities to pass the subject, this subject will be failed directly, without opportunity to recover it in the same course These irregularities include, among others:

- the total or partial copy of a practice, report, or any other evaluation activity;
- let copy;
- present a group work not done entirely by the members of the group;
- present as own, materials which are prepared by a third party, even if they are translations or adaptations,or works with non-original and exclusive elements of the student;

- have communication devices (such as mobile phones, smart watches, etc.) accessible during theoretical-practical assessment tests (individual exams).

g) Evaluation of the students taking the course for second time

For those students taking the course for second time, the grades of the activities *B, C* and *D* are not rolled over from one course for the following. Nevertheless, the mark of the Moodle tests (Activity *A*) will be rolled over. The validation of the grade will be carried out ex officio, without the express request of the student being necessary.. The students taking the course for the second time follow the same norms of evaluation that any one another student.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Activity A	5	2	0.08	4, 5, 6, 9, 12
Activity B	15	2	0.08	1, 4, 2, 3, 13, 5, 6, 7, 8, 9, 12, 11, 10, 14
Activity C	40	2	0.08	1, 2, 3, 13, 6, 9, 12, 10
Activity D	40	2	0.08	7, 8, 9, 12

Bibliography

Platform used for the communication with students: Moodle.

Basic bibliography:

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K. H. Rosen, Matemática discreta y sus aplicaciones, McGraw-Hill, 2004.

C. Fernández-Cuesta, F. Fuentes, Curso de estadística descriptiva, Ed. Ariel, 1995.

J. Calvo, Scilab Programación y simulación, Ed. RA-MA, 2009.

A. Gilat, J. A. Macías, Matlab, Una introducción con ejemplos prácticos, 2006.

N. Quezada, Estadística para Ingenieros, Ed. Marcombo, 1º Edición, 2020.

A. Herrero de Egaña, M. Matilla García, A. Muñoz Cabanes, Cálculo Diferencial para Economía y Empresa, Mc-Graw-Hill, 1º Edición, 2020.

Software

The subject will use the program of scientific computation GeoGebra for the part of Calculus and Excel for the part of Statistics.