UAB
Universitat Autònoma de Barcelona

Mathematics Applied to Engineering

Code: 106924
ECTS Credits: 6

2025/2026

Degree	Type	Year
Management of Smart and Sustainable Cities	FB	1

Contact

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Teaching groups languages

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

Prerequisites

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

Objectives and Contextualisation

The objective of this course is to provide students with the fundamental mathematical tools for solving the technical and scientific problems that arise in the management of smart and sustainable cities.

Learning Outcomes

1. CM01 (Competence) Relate mathematical knowledge and skills with the knowledge and skills provided by other technicians in interdisciplinary teams.
2. KM01 (Knowledge) Explain urban territorial and social processes using relevant theoretical and conceptual mathematical frameworks.
3. KM02 (Knowledge) Identify mathematical concepts in the resolution of environmental, mobility and regional planning problems in a prioritised manner.
4. SM02 (Skill) Identify and use simple mathematical language in the resolution of city management problems.

Content

The syllabus of the subject is made up of the following contents:

Block I. Matrices and systems of equations

Lesson 1. Systems of equations. Concept and systems of two equations.

Lesson 2. Matrices and matrix formulation of systems of equations.

Lesson 3. Gauss method and Rouché-Fröbenius Theorem.

Block II. Infinitesimal calculus

Lesson 4. Concept of function.

Lesson 5. Limits and derivatives. Fundamental theorems of continuous functions and differential calculus.

Lesson 6. Partial derivatives.

Lesson 7. Applications of the derivative (optimization and graphical representation of functions)

Lesson 8. Integration.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Exercises seminars	24	0.96	CM01, KM01, KM02, SM02, CM01
Theory sessions	26	1.04	CM01, KM02, SM02, CM01
Type: Autonomous			
Computer quizzes	5	0.2	KM01, KM02, SM02, KM01
Realization of problems	50	2	CM01, KM01, KM02, SM02, CM01
Study	37	1.48	CM01, KM02, SM02, CM01

The teaching methodology to be followed is aimed at the student's continuous learning of the subject. This process is based on three types of activities that will take place throughout the course: theory classes, problem seminars and computer-based quizzes.

- Theory sessions: the professor will explain the fundamental contents of the subject and the strategies to acquire, extend and organize this knowledge. The active participation of students will be encouraged through exercises and the use of interactive tools for student participation.
- Problem seminars: students will have to participate actively to consolidate the knowledge acquired by solving, presenting and debating problems.
- Computer quizzes: students will have to take quizzes on the topics covered in class in order to bring the subject up to date, consolidate the fundamental skills of the subject and prepare for the written exam tests.

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
Calculus exam	50%	2	0.08	CM01, KM01, KM02, SM02
Exam of matrices and linear systems of equations	25%	2	0.08	CM01, KM01, KM02, SM02
Quizzes	25%	4	0.16	KM02, SM02

The evaluation of the subject will be done progressively and continuously throughout the semester. The evaluation system is based on the following rules:

a) Scheduled evaluation process and activities

The following activities are planned:

• Activity A. Making Questionnaires on the Moodle platform. The subject's Moodle contains four quizzes: one on matrices, one on systems of equations, one on the calculation of one variable and one on the calculation of several variables. Each of the first two quizzes counts for 5% of the subject's final grade, while each of the last two counts for 7.5%. In each one you can see the opening period and the rules of operation.

• Activity B. Examination of the contents of Block I (matrices and systems of equations), to promote the consolidation of all the material worked on during the course. This activity counts for 25% of the final grade of the subject.

• Activity C. Examination of the contents of Block II (calculus), to promote the consolidation of all the material worked on during the course. This activity counts for 50% of the final grade of the subject.

The formula for calculating the final grade is:

NotaFinal = 0.5 NotaExCalc + 0.25 NotaExMatSisEc + 0.05 CuestMat + 0.05 CuestSistEc + 0.075 CuestCal1 + 0.075 CuestCalVar

where each grade is in the range from 0 to 10. To pass the subject (passing means obtaining at least a 5 in Final Note), you will need to obtain a minimum grade of 4.5 in activities, B and C. You must take into account that the Activity A is not recoverable. This means that if you do not complete Activity A in the time and form as indicated in each Moodle questionnaire, it will not be possible to complete it later.

b) Programming of evaluation activities

The calendarization of the assessment activities will take place on the first day of the subject and will be made public through the Virtual Campus (Moodle) and on thewebsite of the School of Engineering, in the exams section. The following schedule is planned:

+ Activity A: to be completed according to the instructions indicated in each Moodle questionnaire.

+ Activity B: Exam Block I: Partial exam in the programmed week. Final exam and recovery: dates to be determined by the school (January 2026).

+ Activity C: Exam Block II: Final Exam and Recovery: dates to be determined by the School (January 2026).

If the student obtains at least a 4.5 in the partial exam of Activity B, this part of the subject is released and will only have to be presented in the exam of block II (Activity C) on the date of the final exam (January 2026). If the student does not get at least 4.5 in the mid-term exam, he/she will have to do this exam (Activity B) together with Activity C on the date of the final exam. Activity A will be evaluated through two possibilities in the quiz where the final grade will be the highest grade obtained from the two attempts.

c) Recovery process

For those students who, at the end of the evaluation process, have not obtained a grade equal to or higher than 4.5 in activities B and C, or whose Final Grade is lower than 5 having done so, there will be a reassessment. This will consist of carrying out, on the date planned by the School, an exam by activity representative of the situations worked on during the course. Students will only have to take the exam for the activity in which they have not obtained at least a 4.5. If a student does not reach the minimum grade of 4.5 in any of the B or C activities and therefore does not pass the subject, the final grade will be a maximum of 4.5, that is, equal to the value of the weighted average (according to section a)ifit is lower than 4.5 or 4.5 if it is higher.

d) Qualification review procedure

For each assessment activity, a review place, date and time will be indicated in which the student can review the activity with the teacher. In this context, claims can be made about the grade of the activity, which will be evaluated by the teaching staff responsible for the subject. If the student does not appear for this review within the set deadlines, this activity will not be reviewed later.

e) Qualifications

The final grade of the subject will be calculated according to the percentages mentioned in section a) of this section. It should be noted that:

• Honorary registrations. Awarding an honors matriculation grade is solely the decision of the faculty responsible for the subject. UAB regulations indicate that MH can only be granted to students who have obtained a final grade equal to or higher than 9.00 and in an amount not exceeding 5% of the number of students in the subject.

• Not assessable. A student who has not taken any B or C activities will be considered "not assessable". In any other case, the assessment criteria detailed above are followed.

f) Irregularities by the student, copying and plagiarism

Without prejudice to other disciplinary measures that are considered appropriate, irregularities committed by the student that could lead to a variation in the grade of an assessment act will be graded with a zero. Therefore, copying, plagiarism, cheating, allowing copying, etc. in any of the evaluation activities it will involve suspending it with a zero. If it is necessary to pass any of these assessment activities to pass the subject, this subject will be suspended directly, with no opportunity to recover it in the same course.

g) Evaluation of repeat students

For repeat students, none of the activity notes are saved from one course to the next. Repeat students follow thesame assessment rules as any other student.

h) Single evaluation

The student who adheres to the single assessment waives the continuous assessment. This resignation is made at the beginning of the teaching of each semester, on the dates set by each center within the framework calendar established in the academic and administrative calendar of the UAB. The link with the information about the single assessment is:

https://www.uab.cat/web/estudis/masters-i-postgraus/masters-universitaris/avaluacio/avaluacio-unica-134588538

The single assessment of the subject is made up of the following assessment activities:

Activity U1. Examination of matrices and systems of equations with a weight of 35%.

Activity U2. Infinitesimal calculus exam, with a weight of 65%.

At least a 4.5 must be obtained in both activities to calculate the final weighted grade. If a 4.5 is not achieved in any of the activities, then the final grade will be the weighted average if it is lower than 4.5 or it will be saturated at 4.5 if the average is greater than 4.5. The same recovery system applies as in the case of continuous assessment.

i) Use of Artificial Intelligence Tools

In this subject, the use of Artificial Intelligence (AI) technologies is allowed as an integral part of the development of the work, provided that the final result reflects a significant contribution of the student in the analysis and personal reflection. The student must clearly identify which partshave been generated with this technology, specify the tools used and include a critical reflection on how these have influenced the process and the final result of the activity. The lack of transparency in the use of AI will be considered a lack of academic honesty and may lead to a penalty in the grade of the activity, or greater sanctions in serious cases.

Bibliography

Platform used to communicate with students: Moodle.

Fundamental Bibliography:

- Huerga Pastor, Lidia y Sama Meige, Miguel Ángel. Curso de introducción al álgebra y al cálculo diferencial e integral en Rn. Universidad Nacional de Educación a Distancia, 2020.
- A. Herrero de Egaña, M. Matilla García, A. Muñoz Cabanes, Cálculo Diferencial para Economía y Empresa, Mc-Graw-Hill, 1º Edición, 2020.
- Chicharro López, Francisco Israel.; Cordero Barbero, Alicia; Martínez Molada, Eulalia; Torregrosa Sánchez, Juan Ramón. Problemas de cálculo en una variable. Universidad Politécnica de Valencia, 2019.
- Larson, Ron.; Edwards, Bruce. Matemáticas. Cálculo diferencial, Cengage Learning, 2017.
- Stewart, James; Redlin, Lothar, Watson, Saleem Precálculo: matemáticas para el cálculo, Cengage Learning, 2017.
- P. García, J.A. Núñez del Prado, A. Sebastián, Iniciación a la matemática universitaria, Ed. Thomson, 2007.
- J. de Burgos, Cálculo infinitesimal, McGraw-Hill, 2007.
- Rosa Barbolla, Paloma Sanz, Teoría de matrices y aplicaciones, Prentice-Hall, 2002.
- J. Arvesú, R. Álvarez-Nodarse, F. Marcellán, Álgebra lineal y aplicaciones, Ed. Síntesis, 1999.

Software

The subject proposes the use of the GeoGebra scientific computing program for the solution of matrix exercises, systems of linear equations and calculus.

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	611	Spanish	first semester	morning-mixed

(PAUL) Classroom practices	612	Spanish	first semester	morning-mixed
(TE) Theory	61	Spanish	first semester	morning-mixed