UAB
Universitat Autònoma de Barcelona

Mathematical Tools I

Code: 106803
ECTS Credits: 6

2025/2026

Degree	Type	Year
Nanoscience and Nanotechnology	FB	2

Contact

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Teachers

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Teaching groups languages

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

Prerequisites

There are none. The content and the methods introduced in this course presuppose knowledge of the first year M
Fonaments de Matemàtiques and
Càlcul.

Objectives and Contextualisation

The aim of the course is to enable the students to use some mathematical tools which are necessary for the study and modeling of nanosystems: analysis and resolution of ordinary and partial differential equations.

Learning Outcomes

1. CM06 (Competence) Identify the mathematical nature of certain physical and chemical phenomena, in order to abstract the essential variables that describe them.
2. CM07 (Competence) Solve real-world problems that occur in the field of science and technology using mathematical tools and methods.
3. KM10 (Knowledge) Identify the basic tools and notions of statistical data processing.
4. SM09 (Skill) Express oneself clearly using basic mathematical language.
5. SM10 (Skill) Solve simple problems related to matrix calculus, linear equations and first order differential equations.
6. SM12 (Skill) Use graphical and numerical methods to explore, describe and interpret data.

Content

I. INTEGRATION ON CURVES AND SURFACAES

- Líne and surface integrals
- Vector Analysis: Teorems of Green, Gauss nd Stokes

II. DIFFERENTIAL EQUATIONS

- Ordinary Diferential Equacions of the First and Second order
- Fourier Series and Transforms
- Introduction to Partial Differential Equations.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Problems classes	12	0.48	CM07, KM10, CM07
Theory classes	36	1.44	CM06, SM09, SM12, CM06
Type: Supervised			
Practical classes	4	0.16	CM07, KM10, SM09, SM10, SM12, CM07
Type: Autonomous			
Personal study	32	1.28	CM06, CM06
Problem solving	60	2.4	CM07, SM09, SM10, SM12, CM07

- Theory classes: The concepts and methods of the different subjects will be introduced, with a variety of examples.

- Problems classes: Teachers will solve selected exercises from a collection that will be available to the students beforehand.

- Practical classes: They will be held in a computer classroom. Activities will be proposed to be carried out by means of an adequate software. The results of this practical work must be presented within a given deadline.

- Autonomous work: It is imperative that students complement face-to-face activities with autonomous, individual or group work; to practice the resolution of problems is especially important.

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
Delivery of solved problems	10%	0	0	CM07, SM09, SM10
Partial exams:	80%	6	0.24	CM06, CM07, SM09, SM10
Results of the practical sessions	10%	0	0	CM07, KM10, SM09, SM12

Partial exams: Two partial tests will be carried out, with a weight in the final evaluation of 40% each. At the end of the course, a re-evaluation exam for this 80% will be held for students who need it.

Practical sessions and delivery of solved problmes: The remaining 20% will come from the evaluation of the delivered problems and from the results of the practical sessions in equal parts. The presentation of the results of the practical sessions will be mandatory.

Re-evaluation: There will be a re-evaluation for one or both partial exams. Only students who have completed 2/3 of the assessment activities, this means both term tests, may opt for the re-evaluation.

The student who carries out evaluation activities that involve less than 50% of the total evaluation will be considered "not assessable".

Single Assessment:

Students following the single evaluation modality must take a final test similar to the pariial exams but comprising all the subject matter. This test will be carried out on the same day that the second partial exam and it will account for a 90% of the grade.

The results of the practical sessions is also mandatory, in the same dates as the other students, and will accounnt for the ramaining 10% of the grade.

If necessary, students could take the same recovery exam as the rest of the students.

Bibliography

- S. L. Salas, E. Hille, G. Etgen, *Calculus: una y varias variables*, vol II, Reverté (2003). https://bibcercador.uab.cat/permalink/34CSUC_UAB/1c3utr0/cdi_digitalia_books_DIGRVRT0116
- W. E. Boyce, R. C. DiPrima, D. B. Meade, *Boyce's Elementary Differential Equations and Boundary Value Problems,* William, John Wiley & Sons (2017)
- J. David Logan, *A First Course in Differential Equations,* Springer 2006 https://bibcercador.uab.cat/permalink/34CSUC_UAB/1eqfv2p/alma991010559602206709
- J. David Logan, *Applied Partial Differential Equations*, Springer 2004 https://bibcercador.uab.cat/permalink/34CSUC_UAB/avjcib/alma991010893893606709

Software

maxima: https://maxima.sourceforge.io/

Python

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	1	Catalan	first semester	afternoon
(PLAB) Practical laboratories	1	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	2	Catalan	first semester	morning-mixed
(TE) Theory	1	Catalan	first semester	afternoon