

## Mathematics II

Code: 105038  
ECTS Credits: 6

**2025/2026**

Degree	Type	Year
Chemistry	FB	1

### 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

A solid understanding of mathematics corresponding to secondary education (including "batxillerat") is required, as well as a strong foundation in the competencies related to the subject of the first semester "Mathematics I".

### Objectives and Contextualisation

The course has three fundamental parts: the differential calculus, integral calculus and vector analysis.

The objectives of the course are:

- (i) Understand the basics in each of these parts. These concepts include
- (ii) Know how to apply the concepts studied coherently to the approach a
- (iii) Acquire skills in mathematical writing and in calculus.

### Learning Outcomes

1. CM04 (Competence) Propose the optimal mathematical tools for solving problems in the field of Chemistry.

2. CM05 (Competence) Solve real, basic mathematical problems applied to chemistry and, to a lesser extent, to other scientific fields.
3. KM04 (Knowledge) Identify the presence of underlying mathematics in science, with special emphasis on chemistry, taking into account analytical thinking, abstraction, and logical and rigorous reasoning.
4. KM05 (Knowledge) Identify elementary mathematical models and tools for calculus, linear algebra, and differential equations.
5. KM06 (Knowledge) Describe the concepts of numerical methods: precision, discretisation, numerical error, conditioning and normalisation for use in solving physical problems.
6. SM05 (Skill) Analyse the mathematical nature of certain chemical phenomena by abstracting essential variables and formulating mathematical models to describe them.
7. SM06 (Skill) Use mathematical calculations to solve simple problems in the field of Chemistry and, to a lesser extent, in other scientific fields.
8. SM07 (Skill) In the field of Chemistry, use graphic and numerical methods in the exploration, description and interpretation of mathematical data.

## Content

(0) Reminder of fundamental concepts (composition of functions, notation, etc).

(1) Functions of several variables

- Geometry of the plane and space.
- Parametric curves. Tangent vector to a curve at a point. Length of a curve.
- Graph of a function, curves, and level surfaces.
- Directional derivatives, gradient.
- Differentiability. Chain rule. Higher-order derivatives. Absolute and relative extrema.
- Critical points, saddle points. Hess's criterion for relative extrema. Lagrange multipliers for absolute extrema.

(2) Multiple integrals.

- Iterated integrals. Fubini's theorem. Cavalieri's principle.
- Change of variable theorem. Polar, cylindrical, and spherical coordinates. Calculation of masses and centers of mass.

(3) Integrals over curves and surfaces.

- Parametric surfaces.
- Surfaces given implicitly. Tangent plane and normal vector to a surface.
- Length of a curve. Line integrals.
- Area of a surface. Flux of a vector field.
- Green's, Gauss's, and Stokes's theorems.

## Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Problems	22	0.88	
Seminars	2	0.08	

Solving problems	39	1.56
Theory	25	1
Type: Supervised		
Tutorials	12	0.48
Type: Autonomous		
Study	39	1.56

The methodology will be the standard for this type of subject with theory classes, problems and a practical session.

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

### Continuous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Final Exam	50%	3	0.12	CM04, CM05, KM04, KM05, KM06, SM05, SM06, SM07
Midterm Exam	40%	3	0.12	CM04, CM05, KM04, KM05, KM06, SM05, SM06, SM07
Recovery Exam	90%	3	0.12	CM04, CM05, KM04, KM05, KM06, SM05, SM06, SM07
Seminar	10%	2	0.08	CM04, CM05, KM04, KM05, KM06, SM05, SM06, SM07

Evaluation Instruments (all grades range from 0 to 10):

- A partial written evaluation test will be conducted, from which grade A1 will be obtained.
- A second partial written evaluation test will be conducted, from which grade A2 will be obtained.
- There will be a practical problem-solving session (seminar) with grade S. The grade S is not recoverable.

With this procedure, the course grade is calculated using the following formula:

$$Q1 = 0.1S + 0.4A1 + 0.5A2.$$

This means the seminar will count for 10% of the total course grade, the first partial test for 40%, and the second partial test for 50%.

The course is considered passed if Q1 is greater than or equal to 5, with a minimum grade of 3,5 required for each of the partial tests A1 and A2. The allocation of honors will be decided at this point.

Those whose Q1 grade is less than 5 will have the opportunity to take a recovery exam, either for the first part of the course, the second part, or for the entire course. If recovering only the first or second part, the previous grade A1 or A2 will be replaced, respectively (meaning the previous grade obtained will be forfeited). If recovering the entire course, the new grade will be

$$Q2 = 0.1S + 0.9R,$$

where R is the grade of the recovery exam for the entire course. Those who, after taking the recovery exam (whether for the first part, second part, or entire course), obtain a grade Q1 or Q2 of 5 or higher will pass the course, although the final course grade will be 5 if it was passed during the recovery period (regardless of the final grade Q1 or Q2).

Students may participate in the recovery to improve their overall course grade Q1 only if it is above 5 before the day of the recovery (meaning a course grade higher than 5 can only be obtained on the day of recovery if Q1 is greater than 5 before the day of recovery).

All evaluation dates will be announced in advance through the Virtual Campus/Moodle to students enrolled in the subject.

Individuals who attend only one or none of the regular assessment evidences (A1, A2, or S), and who also do not attend the recovery exam (R) will receive the grade of "no evaluable".

#### Unique Evaluation

*Students opting for the unique evaluation mode must take a final written exam (resulting in grade A). Subsequently, they must submit a problem assignment. The professors will conduct an interview based on the assignment, and grade P will be obtained from this.*

*The final grade will be  $Q = 0.1P + 0.9A$ . If the grade Q is less than 5, there will be another opportunity to pass the course through the recovery exam scheduled on the date indicated in the exam calendar. In this exam, the grade A can be recovered. The grade P is not recoverable. If the course is passed through the recovery exam, in this case the final course grade will be 5 (regardless of the final grade Q). Not attending the unique evaluation written test nor its recovery will result in the grade of "no evaluable."*

## Bibliography

Notes adapted to the course will be available on the "Campus Virtual".

Other books to delve deeper into the subject are the following:

1. J. E. Marsden y A.J. Tromba. Cálculo vectorial, cuarta edición. Addison-Wesley Longman, 1998.
2. S. L. Salas y E. Hille. Calculus, Vol. 1 y 2, tercera edición. Reverté, Barcelona, 1995 y 1994.
3. B. Demidovich. Problemas y ejercicios de Análisis Matemático. Ed. Paraninfo.

## Software

None.

## 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	second semester	morning-mixed
(PAUL) Classroom practices	2	Catalan	second semester	morning-mixed
(PAUL) Classroom practices	3	Catalan	second semester	afternoon
(PAUL) Classroom practices	4	Catalan	second semester	afternoon
(SEM) Seminars	1	Catalan	second semester	morning-mixed
(SEM) Seminars	2	Catalan	second semester	morning-mixed
(SEM) Seminars	3	Catalan	second semester	afternoon
(SEM) Seminars	4	Catalan	second semester	afternoon
(TE) Theory	1	Catalan	second semester	morning-mixed
(TE) Theory	2	Catalan	second semester	afternoon