

## Analytical Chemistry

Code: 106810  
ECTS Credits: 6

**2025/2026**

Degree	Type	Year
Nanoscience and Nanotechnology	OB	3

### Contact

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### Teaching groups languages

You can view this information at the [end](#) of this document.

### Prerequisites

To have completed the subject of Chemical Reactivity, 1st year Degree in Nanoscience and Nanotechnology

### Objectives and Contextualisation

In this subject the basic knowledge of Analytical Chemistry and Chemical Analysis must be acquired. The main objective is to establish the concepts and methodologies of work, so that the student can apply them in real practical cases. Some examples of application in the field of analytical nanosystems will be mentioned.

The subject is structured in five blocks of homogeneous content but of different duration.

Block 1: The objective of Analytical Chemistry, the analytical process and, above all, the different calibration methods are introduced, as well as basic statistics for its correct use and interpretation of results.

Block 2: Introduction to chromatography. Basic principles; gas chromatography; high resolution liquid chromatography.

Block 3: Brief introduction to the classical methods of wet analysis.

Block 4: Introduction to analytical spectroscopy. Special emphasis will be placed on molecular analysis techniques and the most common atomic analysis techniques will be introduced. The principles and applications of infrared spectroscopy will be described as an example of qualitative analysis.

Block 5: Introduction to electrochemical analysis, especially potentiometric methods and the basic principles of amperometry.

### Learning Outcomes

1. CM13 (Competence) Apply chemical knowledge to solve quantitative and qualitative problems, using bibliographic sources when necessary.
2. CM14 (Competence) Work collaboratively to plan and organise the basic tasks carried out in a physicochemical analysis laboratory.

3. CM15 (Competence) Handle chemical products and wastes while taking their impact on safety and the environment into account.
4. KM23 (Knowledge) Identify the analysis methods and cite the different stages of analysis, as well as the analytical quality indicators.
5. SM21 (Skill) Apply the main techniques used in to identify and characterise the structure and composition of the material.

## Content

### B1. Introduction and data processing

Unit 1. Objective of the Analytical Chemistry. Analytical process. Methods of analysis: classical methods and instrumental methods. Calibration protocols: external calibration, standard addition and internal standard.

Unit 2. Validation of an analytical method. Analytical quality parameters. Precision. Accuracy. Sensitivity. Selectivity. Detection limit and quantification limit.

Unit 3. Statistical evaluation of analytical data. Experimental error, uncertainty and significant figures. Significance tests: t and F. Univariable calibration methods: linear regression.

### B2. Introduction to chromatography

Unit 4. Introduction. Classification of chromatographic techniques. Basic parameters.

Unit 5. Gas chromatography. Instrumentation. Types of columns. Stationary phases. Mass detector coupling. Application examples.

Unit 6. High resolution liquid chromatography. Instrumentation. Application examples

### B3. Classical chemical analysis

Unit 7. Quantitateness of a reaction. Conditional constants. Complexation volumes. Examples of applications.

Unit 8. Sampling. Sampling statistics. Ingamells equation. Sample preparation. Solid phase extraction (SPE).

### B4. Introduction to analytical spectroscopy

Unit 9. Electromagnetic spectrum. Matter radiation interaction. Classification of spectroscopic techniques. Beer-Lambert's law.

Unit 10. Molecular spectroscopy. Classification. UV-Vis spectrophotometry. Luminescence. Optical sensors. Immunoassays. Infrared spectroscopy: application to qualitative analysis.

Unit 11. Atomic spectroscopy. Classification. Atomic absorption spectroscopy. Emission spectroscopy: flame and ICP.

### B5. Introduction to electrochemical analysis:

Unit 12. Potentiometry. Indicator electrodes. Reference electrodes. Selective electrodes. Sensors and biosensors.

Unit 13. Amperometry. Polarography. Basic concept of the amperometric curves. Example of amperometry: blood glucose control.

## Activities and Methodology

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Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory practices	12	0.48	CM14, CM15, CM14
resolution of numerical exercises	10	0.4	CM13, KM23, SM21, CM13
Theory classes	30	1.2	KM23, SM21, KM23
Type: Supervised			
Complementary works (audiovisual or reports)	8	0.32	CM13, KM23, SM21, CM13
Tutorials	4	0.16	CM13, KM23, SM21, CM13
Type: Autonomous			
Bibliographic search	5	0.2	CM13, CM13
Resolution of numerical exercises	20	0.8	CM13, KM23, SM21, CM13
study	50	2	CM13, KM23, SM21, CM13

The student will carry out three types of activities: directed, autonomous and supervised.

1. Supervised activities: Attendance is compulsory and is carried out in the presence of a teacher.
  1. Theoretical classes: The teacher explains the contents of the subject and answers any questions that the student may have.
  2. Problems solving: The knowledge acquired in the master classes and in the autonomous activities of the student, mainly through the study, are applied to the resolution of problems and exercises related to the contents of the subject.
  3. Laboratory practices: They involve the performance of practical work related to the contents of the subject.
2. Autonomous activities: With these activities the student alone, or in group, has to achieve the own competences of the asignatura. These activities include study, problem solving, text reading and bibliography research.
3. Supervised activities: The student can request tutorials of support for the assimilation of the matter exposed in the classes of theory and problems and for the resolution of the complementary works.

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
Laboratory practices reports	15%	3	0.12	CM13, CM14, CM15, KM23, SM21

Partial exams	70%	6	0.24	CM13, KM23, SM21
Presentation of complementary works	15%	2	0.08	KM23

## CONTINUOUS ASSESSMENT

### 1. WRITTEN EXAMS (70%)

A) **Partials:** there are two partials on the concepts of theory and problems (they eliminate matter). The weight of each part will depend on the distribution of hours and matter between parts, the proportion of each part in the final grade may be modified, which will be indicated in the presentation of the subject. The minimum grade to be able to average between the partials is 4.0.

B) **Retaken exams:** the student who does not reach 4.0 in one (or both) partials, will have the possibility to retake the exam.

To be able to attend the recovery of the partial or final exams, you must have taken a minimum of 2/3 of the continuous assessment activities and have a minimum grade of 3.5 taking into account every evaluation activity.

*You need a minimum grade of 4 from the exams to be able to average with the other activities.* If this mark is not reached, the subject will be considered suspended and the mark of the resit exam will be recorded in the minutes.

### 2. CLASSROOM EVALUATION AND DELIVERY ACTIVITIES (15%)

Individual: simulation study of a separation of a sample sample by HPLC

In pairs: presentation of a concept of the syllabus, which will be chosen at the beginning of the course.

### 3. PRACTICES (15%).

Internship reports. Preparation of an internship report.

Attendance at laboratory practices is mandatory. In the event of non-compliance with safety regulations, a student may be expelled from the laboratory and suspended from that day's practice. In the event of serious or repeated non-compliance with safety regulations, he / she may be expelled from the laboratory and suspended from the subject.

To pass the course, a minimum overall grade of 5.0 must be obtained.

## SINGLE ASSESSMENT

Students who have taken the single assessment mode will have to take a final exam consisting of an examination of the entire theoretical and problem syllabus of the course. This test will take place on the day on which the students of the continuous assessment take the exam of the second mid-term. The student's grade will be:

Grade for the course = (Final exam mark - 75% + Laboratory mark - 25%)/100

If the final mark does not reach 5, the student has another opportunity to pass the course by means of retaking an exam that will be held on the date set by the degree coordination office. In this test, 75% of the mark corresponding to the theory part can be recovered. The practical part is not recoverable.

## **Bibliography**

D.C. Harris, C.A. Lucy. Quantitative Chemical Analysis, 9th edition. Mac Millan Education 2016

D.S.Hage, J.R.Carr Analytical Chemistry and Quantitative Analysis, Pearson 2010

G.D. Christian, P. Dasgupta, K.A. Schug, Analytical Chemistry, 7<sup>th</sup> edition, Wiley International, 2014

## Software

To activate the Excel Complement: Data Analysis

## 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	afternoon
(PLAB) Practical laboratories	1	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	2	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	3	Catalan	second semester	morning-mixed
(TE) Theory	1	Catalan	second semester	afternoon