



INTRODUCTION

Short description: Basic notions of different analytical methods and interpretation of results. Study of quality parameters of analytical methods. Fundamentals of UV-visible molecular absorption and emission spectroscopic techniques and their application to compounds of biological interest. Introduction to separation methods: chromatography and electrophoresis. Laboratory safety: basic concepts of chemical and biological safety.

- **Degree:** Biology
- **Module in the Degree Program:** Module I: Instrumental Methods applied to Biology
- **Number of credits:** 3 ETCS
- **Year:** First; Second Semester
- **Type of course:** Mandatory
- **Instructors:** Bianca Menchicchi
- **Language:** English
- **Lecture Schedule:** Tuesdays (10:00-12:00, Room 21, Edificio Biblioteca) and Thursdays (10:00 -11:00; Room 21, Edificio Biblioteca). Lectures begin: 17.02.2026

LEARNING OUTCOMES (Specific Skills)

CE1. Pose and solve qualitative and quantitative problems in biology through scientific hypotheses that can be empirically verified, based on available knowledge and theories.

CE2. Plan, design, and evaluate experiments, using techniques and instruments specific to biological experimentation in the laboratory.

CE3. Work appropriately and safely in a laboratory, including the correct handling and disposal of waste.

E10. Understand the basics of Mathematics, Physics, Chemistry, Statistics, and Computer Science relevant to understanding biological processes in living organisms, and apply with judgment the techniques of observation, measurement, and experimentation specific to Biology.

LEARNING OUTCOMES (General and basics Skills)

CB1. Demonstrate knowledge and understanding in a field of study that builds on general secondary education foundations, typically supported by advanced textbooks, and includes some aspects at the forefront of the discipline.

CG1. Plan and organize time effectively, manage continuous training, and keep knowledge updated with innovations in the scientific field, considering future trends.

CG3. Work effectively in a team, selecting appropriate methodologies, distributing tasks, listening actively, and contributing positively and constructively.

PROGRAM

1. **The analytical process:** introduction, classification of analytical methods, quality parameters of an analytical method, calibration of instrumental method.
2. **Introduction to spectroscopic techniques applied to biological analysis:** basic principles of electromagnetic radiation (EMR) and its interaction with matter: absorption and emission of radiation. The electromagnetic spectrum.
3. **UV-visible molecular absorption spectroscopy:** theoretical aspects and applications to biological analysis; Beer–Lambert law.



4. **UV-visible molecular emission spectroscopy:** UV-visible molecular emission spectroscopy: luminescence, fluorescence, phosphorescence; Jablonski diagram; applications to biologically relevant molecules.
5. **Introduction to separations methods:** Fundamentals of chromatography and types: adsorption, partition, ion exchange, exclusion, and affinity.
6. **Planar chromatography:** paper and thin layer. Applications.
7. **Column chromatography:** High-performance liquid chromatography (HPLC). HPLC chromatograph. Chromatographic parameters. Applications in biology.
8. **Electrophoresis:** fundamentals of electrophoresis, types of electrophoresis, applications
9. **Biological safety in the laboratory:** General safety regulations. Physical risks. Chemical risks. Infectious agents. What to do in case of an accident. Waste regulations at the University of Navarra

EDUCATIONAL ACTIVITIES

Classroom activities

LECTURES: 22 Hours (0.9 ECTS)

- *Methodology:* Presentation of fundamental theoretical concepts in the classroom.
- *Acquired skills:* Understanding of laboratory instrumental techniques and their application in the biological field.

PRACTICAL SESSIONS IN THE LAB (MANDATORY): 10 Hours (0.4 ECTS)

- *Methodology:* Hands-on laboratory sessions. Students carry out experimental work using instrumental techniques, analyze, and evaluate results. Sessions are mandatory
- *Acquired skills:* Familiarity with instrumental laboratory work, evaluation of experimental results, and critical assessment of analytical methods.

PROBLEM SOLVING SEMINARS: 6 Hours (0.24 ECTS)

- *Methodology:* Individual or group work solving problems and exercises, resolving doubts about applications of studied techniques. Sessions are participatory and reinforce theoretical content.
- *Acquired skills:* Practical application of techniques, critical thinking regarding laboratory results.

Out-of-classroom activities

SOLVING PROPOSED EXERCISE: 8 Hours (0.32 ECTS)

- *Methodology:* Practical exercises assigned after each theoretical topic. May be assessed by the instructor.
- *Acquired skills:* Problem-solving, interpretation of results, analysis of experimental errors, and evaluation of analytical methods.

PERSONAL STUDY: 25 Hours (1 ECTS)

- *Methodology:* Independent study of provided and supplementary materials (articles, links, etc.).
- *Acquired skills:* Consolidation of theoretical knowledge to meet subject objectives.

EVALUATION



ORDINARY CALL

The final grade of the subject is the result of:

1. **Theoretical exam grade** (70% of the final grade): it will take place at the end of the course and consists of a theoretical part (30 multiple choice questions and 5 short questions: 35 pt.) and problem-solving part (5 problems: 35 pt.). Duration: 3 hours (0.12 ECTS).

Requirements: it is necessary to achieve a minimum grade of 4 in both theoretical and problem-solving parts. If this minimum grade is not achieved, the student will be graded with the score of the part in which a 4 was not achieved (< 4).

1. **Practical exam grade** (30% of the final grade): it will be held at the end of the laboratory practices and consists of 15 multiple-choice questions, 2 short theoretical-practical questions and 2 problems. Duration: 1.30 hour (0.08 ECTS)

Very important: Students must complete all laboratory sessions and the practical exam to be eligible for the theoretical exam. Otherwise, the course grade will be recorded as *Not Presented*.

EXTRAORDINARY CALL

Same criteria as in the ordinary call.

Students may retain their laboratory score from the ordinary call and are not required to repeat lab sessions.

Additional information:

* Student with a special educational need, will receive an adaptation of both the training activities and the evaluation while maintaining the quality of teaching.

* Plagiarism will result in failure of the course, and previously obtained grades or merits will not be considered.

OFFICE HOURS

Dra. Bianca Menchicchi(bmenchicchi@unav.es)

- Office 1232, First floor (Edificio de Investigación)
- Tutoring time: by appointment

BIBLIOGRAFÍA Y RECURSOS

Skoog, D. A., Holler, F. J., & Crouch, S. R. (2007). *Principles of instrumental analysis*. (6th ed.). Thomson Brooks/Cole. [Find in the library](#)