# Electromagnetism Laboratory

Code: 100151
ECTS Credits: 5

2024/2025

| Degree | Type | Year |
|---|---|---|
| 2500097 Physics | OB | 2 |

## Contact

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## Teachers

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Maria Gisbert Alcantud

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## Teaching groups languages

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

## Prerequisites

There are no prerequisites but it is recommended to be studying or to have studied the subject Electromagnetism.

## Objectives and Contextualisation

The objectives of this course are:

- The experimental study of the main laws of electromagnetism.

- To acquire experience in the experimental work of the laboratory.

- To acquire experience in the writing of lab reports (concise and precise scientific language).

- To acquire experience in teamwork as well as the development of skills in collective work.

## Competences

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- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Communicate complex information in an effective, clear and concise manner, either orally, in writing or through ICTs, and before both specialist and general publics
- Develop strategies for analysis, synthesis and communication that allow the concepts of physics to be transmitted in educational and dissemination-based contexts
- Formulate and address physical problems identifying the most relevant principles and using approximations, if necessary, to reach a solution that must be presented, specifying assumptions and approximations
- Plan and perform, using appropriate methods, study, research or experimental measure and interpret and present the results.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Use computer tools (programming languages and software) suitable for the study of physical problems
- Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments
- Work independently, have personal initiative and self-organisational skills in achieving results, in planning and in executing a project
- Working in groups, assume shared responsibilities and interact professionally and constructively with others, showing absolute respect for their rights.

## Learning Outcomes

1. Analyse and assess the adequacy of the assemblies prepared and carried out, in order to obtain measurements and the desired results.
2. Analyse the influence of various parameters on the simulation of an experiment.
3. Communicate complex information in an effective, clear and concise manner, either orally, in writing or through ICTs, in front of both specialist and general publics.
4. Correctly assess the uncertainty associated with a measure or set of measures.
5. Describe physical phenomena, identify variables, analyse the influence, presenting the results and conclusions of the work developed in a clear and precise manner.
6. Describe the function and manner of operation of the measuring instruments used.
7. Determine and measure the variables that describe a physical system.
8. Discriminate to the most important dependencies and draw the most conclusions from a set of experimental measurements.
9. Explain the explicit or implicit code of practice of one's own area of knowledge.
10. Foster discussion and critical thinking, evaluating the precision and characteristics of the results obtained.
11. Identify the social, economic and environmental implications of academic and professional activities within one's own area of knowledge.
12. Suitably present the results of a series of measures through graphs and perform linear regressions.
13. Use basic programmes to write reports and carry out basic data processing.
14. Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments
15. Use digital sensors for measuring magnitudes.
16. Work independently, take initiative itself, be able to organize to achieve results and to plan and execute a project.
17. Working in groups, assume shared responsibilities and interact professionally and constructively with others, showing absolute respect for their rights.
18. Write and present the results and conclusions of experimental work with rigor and conciseness.

## Content

The subject consists of a theoretical part and a practical part. The theory gives the bases and deepens on each one of the following lab experiments:

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1) Representation of electrostatic fields and potentials.

2) Force between electric currents.

3) RLC circuit in the transitory and permanent regimes.

4) Transformers and mutual inductances.

5) Measurement of the metal resistor as a function of the temperature.

6) Cathode ray beams.

7) Magnetic field measurements in circular wires and coils.

## Activities and Methodology

| Title | Hours | ECTS | Learning Outcomes |
|---|---|---|---|
| Type: Directed | | | |
| Lab sessions | 30 | 1.2 | 1, 2, 4, 5, 6, 7, 8, 10, 12, 13, 15, 16, 17, 18 |
| Theoretical lectures | 10 | 0.4 | 1, 10, 16, 17 |
| Type: Supervised | | | |
| Tutorials | 8 | 0.32 | 1, 3, 5, 6, 8, 10, 12, 13, 18 |
| Type: Autonomous | | | |
| Personal work | 75 | 3 | 1, 2, 4, 5, 6, 7, 8, 10, 12, 13, 16, 17, 18 |

Theoretical lectures

Directed lessons in which the teacher will give the key points of the different parts of the content as well as the guidelines to follow to deepen it through the bibliography. This type of lesson is intended to give a complete and orderly description of the topic of the subject.

Lab sessions

Supervised activity aimed at the students (in groups of 3-4 students) to carry out different practices based on guide notes previously distributed and worked on. Supervision by the teaching staff will help to resolve any doubts that may arise in the laboratory.

Personal work

Before arriving at the laboratory, the student must have previously prepared the notes. Once these have been carried out, the student must work individually as well as in teams to understand the concepts learned and prepare the reports with which the student will be evaluated.

Tutorials

Throughout the course, discussion will been couraged between each of the student groups and the teachers. The teachers of the subject will be available to resolve doubts in tutorial sessions. At the beginning of the course, it will be easier to contact the teachers to define these possible tutorials.

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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 |
|---|---|---|---|---|
| Reports (in group) | 45% | 0 | 0 | 1, 2, 4, 5, 6, 7, 8, 10, 12, 13, 14, 15, 16, 17, 18 |
| Score of laboratory sessions | 5% | 0 | 0 | 1, 2, 3, 4, 7, 8, 9, 11, 15, 16 |
| Written examination | 50% | 2 | 0.08 | 1, 2, 4, 5, 6, 7, 8, 10, 14, 16, 17, 18 |

Continuous Assessment:

The subject will be evaluated as follows:

*Score of the laboratory sessions (5%): attendance, prior preparation and active participation in laboratory sessions (individual).

*Lab reports (45%): reports (by group) of the practices carried out in the laboratory sessions. The requirements that must be met from the reports are written in a document that will be provided to the students.

*Written examination (50%): individual written examination to be carried out at the end of the course consisting of various questions aimed to assess the student's understanding of the basis and functioning of the practices.

Single Assessment:

Students who opt for the single assessment will have to take a test consisting of a written exam (50%) of all the content, both theoretical and practical. This test will take place on the same day, at the same time and place as the written exam of the continuous assessment. Afterwards, at the end of the test, the students of the single assessment must hand in the practical reports (45%), reports that they will prepare individually. The practicals are also compulsory for single assessment students and, in the laboratory sessions in which these practicals are carried out, the students will be assessed (5%) like the rest of the students.

In both types of assessment, in order to pass the course, a minimum mark of 3.5 will be required in both the written exam and the practical reports. It must be taken into account that the practical reports are not recoverable, therefore, failing them with a grade lower than the one indicated above means not being able to pass the course. The written exam can be made up. In order to be eligible for the make-up exam, the student must have been previously assessed in both the written exam and the practical reports. The recovery procedure will be the same in both the single assessment and the continuous one but each recovery will take place on the date scheduled by the coordination of the degree.

Attendance at the laboratory sessions is compulsory for both continuous and single-assessment students. Failure to attend these sessions will result in a final mark of "Not assessable". In the same way, the student who does not attend the written exam will also be considered "Not assessable".

The course is considered to be passed when the minimum grade for the final mark is 5.0. Once the subject has been passed, it cannot be re-evaluated.

Granting with an honourable distinction (HD) is a decision of the responsible teacher for the subject. The HDs can only be granted to students who have obtained a grade equal to or greater than 9.0. The number of HDs will not exceed 5% of the total number of students enrolled.

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Without prejudice to other disciplinary measures deemed appropriate, the irregularities committed by the student that may lead to a variation in the grade of an evaluation act will be scored with a zero. Therefore, copying, plagiarism, cheating, letting copy, etc. in any of the evaluation activities will involve suspending such activity with a zero without the opportunity to recover it. If it is necessary to pass any of these evaluation activities in order to pass the course, the course will be suspended directly without the opportunity to recover it in the same course.

After the second enrolment, the evaluation of the subject will consist of a written examination (50%), which will be carried out at the end of the course, plus the grade corresponding to the practice reports (45%) and the grade of the laboratory sessions (5%) obtained the first time the student was registered and which was equal to or greater than 5. In this case, attendance at the laboratory sessions will not be necessary. To select this differentiated assessment, the repeating student must notify the teacher by email (nuria.delvalle@uab.cat) no later than 15 days after the start of classes.

## Bibliography

- The students will receive a copy (Campus Virtual) of the guide notes of the lab experiments to carry them out.
- Theory books:


1. J. Costa Quintana y F. López Aguilar, *Interacción electromagnética. Teoría clásica*, (Reverté 2007). ISBN: 978-84-291-3058-4.
2. R.P. Feynman, R.B. Leighton y M. Sands, Feynman. *Física. Vol. II (Addison-Wesley Iberoamericana, 1987)*. ISBN: 0-201-06622-X.
3. D.J. Griffiths, *Introduction to Electrodynamics*, Fourth Edition, (Cambridge, 2017). ISBN: 978-1-108-42041-9.
4. P. Lorrain y D.R. Corson, *Campos y Ondas Electromagnéticos* (Selecciones Científicas, 1990). ISBN: 84-85021-29-0.
5. J. R. Reitz, F. J. Milford, y R. W. Christy, *Fundamentos de la Teoría Electromagnética*, (Addison-Wesley Iberoamericana, 1996). ISBN: 0-201-62592-X.
6. R. K. Wangsness, *Electromagnetic fields*, (John Wiley & Sons, 1986, 2nd edition) ISBN: 0-471-81186-6; *Campos electromagnéticos*, (Limusa, 1989).ISBN: 968-18-1316-2.


- Other books on general topics recommended in previous teaching laboratories.

## Software

This subject does not use specific programmes but familiarity with some form of word (Latex, Word, etc.) and data (Gnuplot, Origin, Excel, Matlab, etc.) processing is recommended.

## Language list

| Name | Group | Language | Semester | Turn |
|---|---|---|---|---|
| (PLAB) Practical laboratories | 1 | Catalan | second semester | afternoon |
| (PLAB) Practical laboratories | 2 | Catalan | second semester | morning-mixed |
| (PLAB) Practical laboratories | 3 | Catalan | second semester | afternoon |

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|---|---|---|---|---|
| (PLAB) Practical laboratories | 4 | Catalan | second semester | afternoon |
| (PLAB) Practical laboratories | 5 | Catalan | second semester | afternoon |
| (TE) Theory | 1 | Catalan | second semester | morning-mixed |

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