

**Electromagnetism Laboratory**

Code: 100151  
ECTS Credits: 5

Degree	Type	Year	Semester
2500097 Physics	OB	2	2

**Contact**

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**Use of Languages**

Principal working language: catalan (cat)  
Some groups entirely in English: No  
Some groups entirely in Catalan: Yes  
Some groups entirely in Spanish: No

**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**

- 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:

- 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.

## Methodology

### 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 be encouraged 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.

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.

## **Activities**

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

## **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.

In order to pass the course, a minimum score of 3.5 in both the written examination and the practice reports will be required. It must be taken into account that reports are not recoverable, therefore, failing them with a

grade lower than that indicated above implies not being able to pass the subject. The written examination is retake. To be eligible for recovery one must have been previously evaluated both the written examination and the reports of practices.

Attendance at laboratory sessions is mandatory. Failure to attend such sessions implies a final grade of "Not assessable". Similarly, a student who does not take the written exam will also be considered "Not assessable".

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.

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 it the teacher by email (nuria.delvalle@uab.cat) no later than 15 days after the start of classes.

Our teaching approach and assessment procedures may be altered if public Health authorities impose new restrictions on public gatherings for COVID-19.

## Assessment Activities

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

## 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.