# Mechanics and Electromagnetism Laboratories

Code: 107613
Credits: 6

2026/2027

| Degree programme | Type | Course |
|---|---|---|
| Physics | OB | 2 |

## Contact lecturer

Name : Carlos Domingo Miralles

Email : carles.domingo@uab.cat

## Teaching staff

Nuria Valle Benedi

Victoria Moreno Balta

Pau Solsona Mateos

Immaculada Martinez Rovira

## Group languages

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

## Prerequisites

There are no prerequisites, but it is very convenient to have solid knowledge of the fundamental laws and theoretical principles of General Physics, acquired during the first semesters of the Degree in Physics as well as the double degrees in Physics and Mathematics and Physics and Chemistry. It is recommended that students review this knowledge to carry out this subject. It is advisable to be studying or have taken the subject Electromagnetism. It is also advisable to refresh the theoretical and practical knowledge acquired in the first-year subject Introduction to Experimental Physics.

## Objectives

The objectives of the subject consist are:

1. To apply the fundamental laws and theoretical principles of General Physics acquired by the student during the first semesters of the Bachelor's Degree in Physics as well as the Bachelor's Degrees in Physics and Mathematics and Physics and Chemistry, specifically in the fields of Mechanics and Electromagnetism.
2. To consolidate the skills related to an experimental subject: importance of instrumentation in the design of experiments, use of measuring devices and voltage and current sources, data acquisition in the laboratory, introduction to data analysis methods, use of computers in the laboratory, etc.
3. To awaken in students a critical mentality regarding the level of confidence in their measurements, the performance of calculations and the interpretation of the results.
4. To gain experience in writing practice reports, in scientific and precise language.

5. To gain experience in group work and develop collective work skills.
6. To motivate students in bibliographic research to interpret experimental results and/or deepen other approaches to a given experiment.

## Learning outcomes

- CM11 (Work as a team in the execution of practices, data analysis and reporting.) Work as a team in the execution of practices, data analysis and reporting.
- CM12 (Apply the principles of classical mechanics, electromagnetism, thermodynamics and optics to the interpretation of experimental results.) Apply the principles of classical mechanics, electromagnetism, thermodynamics and optics to the interpretation of experimental results.
- KM13 (Identify the computer tools (programming languages and software) that are suitable for the analysis of experimental data.) Identify the computer tools (programming languages and software) that are suitable for the analysis of experimental data.
- KM14 (Describe the results obtained in an experiment, putting them in context with the corresponding physical principles in the field of classical mechanics, electromagnetism, thermodynamics and optics.) Describe the results obtained in an experiment, putting them in context with the corresponding physical principles in the field of classical mechanics, electromagnetism, thermodynamics and optics.
- SM08 (Operate the measuring instruments used in a basic physics laboratory.) Operate the measuring instruments used in a basic physics laboratory.
- SM09 (Use appropriate methods to plan a study, measurement, or experimental research in the field of basic physics, and interpret and present the results.) Use appropriate methods to plan a study, measurement, or experimental research in the field of basic physics, and interpret and present the results.
- SM10 (Correctly assess the uncertainty associated with a measure or set of measures.) Correctly assess the uncertainty associated with a measure or set of measures.
- SM11 (Present the results of a series of measurements using graphs in an appropriate way.) Present the results of a series of measurements using graphs in an appropriate way.

## Contents

This subject has a total teaching load of 6 ECTS credits, the face-to-face part of which is distributed in theory sessions at the beginning and the practice sessions afterwards.

The theory classes represent 2 face-to-face hours where a general introduction will be made: framework and objectives of the subject, general rules and procedures, evaluation criteria, calendar of practices and exams, group formation.

The final list of practices to be carried out in the laboratory will be posted on the virtual campus and will be delivered to the students at the beginning of the course. Each student will carry out 4 practices in Mechanics and 4 in Eectromagnetism. The provisional list of available demonstrations (this list may vary depending on the availability of the material) is as follows:

- The sonometer.
- Oscillations.
- Non-relativistic collisions.
- Relativistic collisions.
- Coupled oscillations.
- Rotation.
- Wave analysis and synthesis.

- Representation of electrostatic fields and potentials.
- Forces between currents.
- RLC circuit in transitional and permanent regime.

- Transformers and mutual inductance.
- Measurement of the resistance of a metal as a function of temperature.
- Cathode ray beams.
- Measurement of the magnetic field of coils and coils.

## Learning activities and methodology

| Title | Hours | ECTS | Learning outcomes |
|---|---|---|---|
| Theoretical lessons | 2 | 0.08 | CM12 |
| Practical lessons at the laboratory | 40 | 1.6 | CM11, CM12, KM13, KM14, SM08, SM09, SM10, SM11 |
| Personal work | 90 | 3.6 | CM11, CM12, KM14, SM09, SM10, SM11 |
| Tutoring and feedback | 18 | 0.72 | CM11, CM12, KM14, SM09 |

Theoretical classes

At the beginning of the course, two hours of theoretical classes will be taught. With this type of class it is intended to give a complete and orderly description of the subject of the subject, as well as the organizational rules that must be followed. Recommendations will be given on how to present the results of the internship. This information must be completed with the recommended bibliography and the material that is posted on the Virtual Campus.

Practical sessions in the laboratory

Supervised activity aimed at the students, in groups, carrying out the different practices. Students will have the scripts of the practices in advance for their preparation (via Virtual Campus). Supervision by the teaching staff will help to resolve any doubts that arise in the laboratory.

Tutorials

Throughout the course, discussion will be encouraged between groups of students and practice teachers. The teaching staff of the subject will be available to resolve doubts in tutorial sessions. At the beginning of the course, the channels of contact with the teaching staff will be facilitated to define these possible tutorials.

Personal work

It will be necessary to study, personally, the theory and also prepare the practices beforehand (before going to the laboratory). Then, in individual and group work, the students will work to understand the concepts learned and to deliver the practice answer sheets, with which they will be evaluated.

General rules

Students must be punctual and no delays will be allowed in this aspect. In the same way, the end time of the internship session must be respected.

Before entering the laboratory, students must leave their personal belongings in the spaces provided.

It is mandatory that each student has the necessary material (laptop, laboratory notebook, pens, pencils, rulers, calculator, memory stick, etc.) to carry out the practices.

Given the fragility of the material used in the practices, the utmost attention and delicacy is requested in its handling and that the corresponding recommendations are followed in order to prevent it from being damaged.

This material will remain the responsibility of the students, who cannot leave the laboratory without the teachers having checked its good condition.

Students must behave appropriately in the laboratory. Therefore, smoking, eating, making noise, and talking on mobile phones is strictly prohibited.

The preparation of a practice begins before entering the laboratory and, therefore, it is essential to have previously read the practice script. The teachers reserve the right to grade with a 0 the student who has not adequately carried out this preparation of the practice.

Practical sessions

Within the laboratory it is necessary to maintain an active attitude and to pay the utmost attention and delicacy in the realization of experimental set-ups. The acquisition of data must be carried out in an orderly and clear manner, which is essential for its analysis and interpretation of the corresponding results. At the beginning of the course, it will be specified how the results of the practices must be presented and recorded in the laboratory notebook, if applicable. All the results obtained must be presented correctly in tables with the corresponding uncertainties and units. The expression of uncertainties must follow the recommendations of the ISO, The graphs must be presented indicating the magnitudes represented, the corresponding units, the bars of uncertainties and the results of the adjustments if necessary.

All students who have a laptop are advised to use it for the recording of experimental data, which greatly facilitates the subsequent work.

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 | Weight | Hours | ECTS | Learning outcomes |
|---|---|---|---|---|
| Laboratory marks (Mechanics) | 20% | 0 | 0 | CM11, CM12, KM13, KM14, SM08, SM09, SM10, SM11 |
| Laboratory exam (Mechanics) | 20% | 0 | 0 | CM12, KM14, SM08, SM09, SM10, SM11 |
| Evaluation of the laboratory notebook (Mechanics) | 10% | 0 | 0 | KM14, SM10, SM11 |

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|---|---|---|---|---|
| Delivery of the answer sheets of the practices (Electromagnetism) | 20% | 0 | 0 | CM11, CM12, KM13, KM14, SM08, SM09, SM10, SM11 |
| Preparatiion of the practical sessions (Electromagnetism) | 7,5% | 0 | 0 | CM11, CM12, SM10 |
| Laboratory exam (Electromagntism) | 22,5% | 0 | 0 | CM12, KM14, SM08, SM09, SM10, SM11 |

Overall grade of the subject:

In the subject, the Mechanics Laboratory and the Electromagnetism Laboratory are evaluated separately.

Under normal conditions, the grade of the subject is obtained as the average between the grades of the Mechanics laboratory and the Electromagnetism laboratory, provided that these grades are both equal to or greater than 3.5 points out of 10. In the event that the grade of any of the parts is less than 3.5, the grade of the subject will be "fail", and the numerical grade will be the minimum between 3.5 and the average grade obtained.

Given the practical nature of the subject and given the follow-up in continuous evaluation throughout the course of the students, there is no repechage exam.

Attendance at all practice sessions is mandatory. A mechanism will be established so that students who have documentally justified absences can carry out the affected internship. Students who have unjustified absences will have the grade of "not assessable" in the subject,

Grade from the Mechanics laboratory:

The grade of the Mechanics laboratory will be based on the work done both in group and individually.

- Each student must take an individual practical exam in the Mechanics laboratory (practical exam).
- The laboratory notebook is evaluated individually based on the drying during the practical sessions and the revision of the notebook on the day of the laboratory exam.
- In addition, the teaching staff evaluates in each practice session the group work carried out in the laboratory, as well as the previous preparation of each practice by each group (laboratory note). This part of the evaluation represents the continuous continuation of the work done by each group.

The grade of the Mechanics laboratory is calculated as follows:

Mechanics Laboratory Grade = Laboratory Grade x 0.4 + Laboratory Notebook Evaluation x 0.2 + Practical Exam x 0.4

In order to pass the subject, it is an essential requirement to have evaluated all three parts of the grade (practical exam, laboratory notebook and laboratory grade). Students who have not evaluated any of the three parts will have the qualification of "not evaluable".

The internship faculty reserves the right to conduct individual interviews when deemed necessary.

Grade from the Electromagnetism laboratory:

The Electromagnetism laboratory is evaluated as follows:

- Preparation of the practical session (15%): It is evaluated based on an interview with each group of practices at the beginning of each session.
- Result sheet (40%): The result sheets are delivered at the end of each practice session.

- Individual practical exam (45%): Each student must take an individual practical exam in the laboratory

Thus, the grade of the Electromagnetism laboratory, is calculated as

Electromagnetism Laboratory Grade = Practical Repair Grade x 0.15 + Result Sheet Grade x 0.4 + Practical Exam x 0.45

In order to pass the subject, it is an essential requirement to have all three parts of the grade evaluated. Students who have not evaluated any of the three parts will have the qualification of "not evaluable".

Single assessment:

Given that the evaluation of the subject is based on activities that take place face-to-face during laboratory practices , no difference is foreseen in the evaluation activities of the students who opt for the single evaluation compared to the rest of the students.

Restricted use of AI:

For this subject, the use of Artificial Intelligence (AI) technologies is allowed exclusively in support tasks, such as the prior preparation of content, the deepening of concepts given in class (although they recommend the use of the proposed bibliography), the resolution of doubts of both a theoretical and practical nature, whether problems or practices (although they strongly recommend the realization of tutorials with the teaching staff of the subject for these tasks in particular), the translation of texts or any other support task. As for the evaluation activities, their use is not allowed. Any work submitted for evaluation that includes AI-generated fragments will be considered a lack of academic honesty and may result in a partial or total penalty in the grade of the activity, or greater penalties in cases of severity.

Fraud, plagiarism and misuse of AI:

The performance of any irregularity in an assessment act (academic fraud, plagiarism or improper use of AI, unless such use is expressly authorised in the teaching guide), which may lead to a significant variation in the grade, means that this act will be graded with a 0. In the event that the teaching guide provides that in order to pass the subject it is an essential requirement to have obtained a minimum grade in this evaluation act or that there are several irregularities in the evaluation acts of the same subject, the final grade of this subject is 0. Apart from this, a disciplinary process may be initiated against the student who incurs in any of these irregularities.

## Bibliography

Students will find the guides for the demonstrations to be performed and other relevant material at the Campus Virtual

Relevant bibliography:


- M. Alonso, E.J. Finn. Física. Editorial Adison-Wesley, Mèxic (1995).
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McGraw-Hill, New York.
- S. Burbano de Ercilla, E. Burbano García, C. Garcia Muñoz. Física general. Editorial Tébar, SL. Madrid, 32ª edició (2003).
- J. Costa Quintana y F. López Aguilar, Interacción electromagnética. Teoría clásica, (Reverté 2007). ISBN: 978-84-291-3058-4.
- R.P. Feynman, R.B. Leighton y M. Sands, Feynman. Física. Vol. II (Addison-Wesley Iberoamericana, 1987). ISBN: 0-201-06622-X.
- A.P. French, Relatividad Especial, Editorial Reverté 1974.
- D.J. Griffiths, Introduction to Electrodynamics, Fourth Edition, (Cambridge, 2017). ISBN: 978-1-108-42041-9.
- P. Lorrain y D.R. Corson, Campos y Ondas Electromagnéticos (Selecciones Científicas, 1990). ISBN: 84-85021-29-0
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- J. R. Reitz, F. J. Milford, y R. W. Christy, Fundamentos de la Teoría Electromagnética, (Addison-Wesley Iberoamericana, 1996). ISBN: 0-201-62592-X
- Roller, D.E.; Blum, R. (1986). Física. Mecánica, Ondas y Termodinámica. Editorial Reverté, S.A.
- Sears, F.W; Zemansky, M.W.; i Young, H.D. (1986). Física Universitaria. Addison-Wesley Iberoamericana, Delaware, U.S.A.
- P.A. Tipler, G. Mosca. Física para la Ciencia y la Tecnología (vol 1) Editorial Reverté, 5ª Edició, Barcelona (2004).
- C.W. van der Merwe. Física General. Sèrie Schaum, Mc Graw-Hill, Mèxic (1979).
- 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.

## Software

This subject does not use any specific software but it is recommended that students are familiar with a text editing program (Word, Latex, etc.) and data processing (Gnuplot, Excel, Origin, Matlab, etc.).

### Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE

| Type of teaching | Group | Language | Semester | Shift |
|---|---|---|---|---|
| (TE) Theory | 1 | Catalan/Spanish | first semester | morning-mixed |
| (PLAB) Practical laboratories | 1 | Catalan/Spanish | first semester | morning-mixed |
| (PLAB) Practical laboratories | 2 | Catalan/Spanish | first semester | morning-mixed |
| (PLAB) Practical laboratories | 3 | Catalan/Spanish | first semester | morning-mixed |
| (PLAB) Practical laboratories | 4 | Catalan/Spanish | first semester | morning-mixed |
| (PLAB) Practical laboratories | 5 | Catalan/Spanish | first semester | morning-mixed |