Universitat Autònoma de Barcelona

2019/2020

Laboratory Mechanics

Code: 100150
ECTS Credits: 5

Degree	Type	Year	Semester
2500097 Physics	OB	2	1

Contact

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Use of Languages

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

Other comments on languages

The teaching of the subject is done indistinctly in Catalan / Spanish

Teachers

Lluís Font Guiteras
Markus Gaug
Miguel Ángel Caballero Pacheco
Victoria Moreno Balta

Prerequisites

It is very convenient to have solid knowledge of the fundamental laws and the theoretical principles of General Physics, acquired during the first semesters of the Degree in Physics as well as the double degrees of Physics and Mathematics and Physics and Chemistry. It is recommended that each student review these knowledge to carry out this subject. It is also convenient to refresh the theoretical and practical knowledge acquired in the subject Initiation to Experimental Physics in the first year.

Objectives and Contextualisation

The objectives of the Mechanics and Wave Laboratory can be summarized as follows:

1. To apply the fundamental laws and the theoretical principles of General Physics acquired by the student during the first semesters of the Physical Degree as well as of the Degree of Physics and Mathematics and of Physics and Chemistry
2. To consolidate the competences related to an experimental subject: importance of the instrumentation in the design of experiments, use of measuring devices, acquisition of data in the laboratory, introduction to the methods of data analysis, use of computers in the laboratory , etc.
3. Awakening in the student a critical mentality that refers to the level of confidence of their measurements, the calculation and the interpretation of the results.

4. To motivate the student in the bibliographic research to interpret the experimental results and / or deepen in other approaches on a given experiment.To

Competences

- Act, and issue reports and judgments, with ethical and social responsibility, according to legal, prevention-based and environmental conditions.
- Develop critical thinking and reasoning and know how to communicate effectively both in the first language(s) and others
- Develop independent learning strategies
- 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.
- Respect the diversity and plurality of ideas, people and situations
- Use computer tools (programming languages and software) suitable for the study of physical problems
- 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. Act, and issue reports and judgments, with ethical and social responsibility, according to legal, prevention-based and environmental conditions.
2. Analyse and assess the adequacy of the assemblies prepared and carried out, in order to obtain measurements and the desired results.
3. Analyse the influence of various parameters on the simulation of an experiment.
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. Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
9. Develop independent learning strategies.
10. Discriminate to the most important dependencies and draw the most conclusions from a set of experimental measurements.
11. Foster discussion and critical thinking, evaluating the precision and characteristics of the results obtained.
12. Respect diversity in ideas, people and situations.
13. Suitably present the results of a series of measures through graphs and perform linear regressions.
14. Use basic programmes to write reports and carry out basic data processing.
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

This subject has a total teaching load of 5 ECTS credits, the attendance part of which is distributed in theory sessions at the beginning and the practical sessions below.

The theory classes represent 10 hours in person where the following points are discussed
1. General introduction: framework and objectives of the subject, general norms, evaluation criteria, practical and examinations, group formation.
2. Presentation of laboratory practices.
3. Procedures: elaboration of the report of practices, presentation and discussion of tables and graphs, notions of statistics, calculation of uncertainties, linear regressions, analysis and interpretation of the main results.

The final list of practices to be done in the laboratory will be uploaded to the virtual campus and will be delivered to the students at the start of the course. Provisional list of available practices (this list may vary depending on the availability of the material):

1. The sonometer.
2. Oscillations.
3. Non-relativistic collisions.
4. Relativistic collisions.
5. Coupled oscillations.
6. Rotation.
7. Analysis and synthesis of waves

Methodology

- General rules

Student assistance is mandatory. An absence without previous justification will imply a qualification 0 in the corresponding practice. Two absences without justification imply the possibility of passing the subject. Justified absences should be recovered.

The students will have to be punctual and delays will not be accepted. In the same way the time of completion of the practice session must be respected.
Before entering the laboratory, students must leave their personal belongings in the adequate spaces.
It is mandatory for each student to have the necessary material (laptop, notebook, pens, pencils, rules, calculator, memory pen, etc.) to perform the demonstrations. Each group must have a lab book that will be evaluable.
Given the fragility of the material used in the demonstrations, the highest attention and delicacy in handling is demanded and the corresponding recommendations have to be followed in order to prevent it from becoming damaged. This material will remain under the responsibility of the students, who can not leave the laboratory without the supervisors having checked their good condition.

The students should have an appropriate behavior within the laboratory. Therefore, it is strictly prohibited to smoke, eat, make noise and talk on a mobile phone.

The preparation of a practice begins before entering the laboratory and, therefore, it is indispensable to have previously read the practice guideline. The teachers reserve the right to qualify with 0 to the student who has not done this preparation properly.

- Completion of practices

In the laboratory, keep an active attitude and give maximum attention and delicacy in the realization of the experimental assemblies. The acquisition of data must be carried out in an orderly and clear manner, an essential aspect for its analysis and the interpretation of the corresponding results. At the beginning of the course, the number ofreports to be prepared, both individually and as a group, will be specified. The reports must consist of the following parts: introduction and objectives, results, conclusions, bibliography and an annex where the expressions used for the evaluation of uncertainties are detailed. All the results obtained in tables

with the uncertainties and corresponding units must be presented correctly. The uncertainties must have at most two significant figures. The graphs must be presented indicating the magnitudes represented, the corresponding units, the bars of uncertainties and the results of the adjustments if applicable.

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

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Introduction and presentation of the subject	10	0.4	
Practical tasks at the laboratory	30	1.2	
Type: Supervised			
Supervision of the first practical report	6	0.24	
Type: Autonomous			
Preparing demonstrations	15	0.6	
Reports from demonstrations	60	2.4	

Assessment

The qualification of this subject will be based on the work done both in group and individually.

Each student must carry out an individual practical examination in the laboratory (practical final exam).
Students must submit a report of practices of the laboratory sessions individually.
In addition, the professors evaluate the work done in a group in the laboratory, as well as the preparation of each practice by each group (laboratory note) in each practice session. This part of the assessment represents the continuous follow-up of the work done by each group.

The final grade of the subject is obtained as follows:

Final note = Laboratory Note x 0.4 + Note Reports x 0.2 + Practical Exam x 0.4

In order to pass the subject, it is an indispensable requirement to have evaluated all three parts of the note (practical exam, report delivery and laboratory note). Practice professors reserve the right to conduct individual interviews when they deem it necessary.

At the beginning of the course, the specific evaluation criteria of each of the assessment activities will be specified.

Given the practical nature of the subject and given the follow-up in continuous evaluation throughout the course of the students, no repesca examination is foreseen.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Final practical exam	40%	4	0.16	1, 2, 4, 6, 5, 9, 8, 7, 10, 11, 13, 16, 15

Laboratory qualification	40%	0	0	1, 2, 3, 4, 6, 5, 9, 8, 7, 10, 11, 13, 18, 12, 17, 14
Reports from demonstrations	20%	0	0	1, 2, 3, 4, 6, 5, 9, 8, 10, 11, 13, 18, 12, 16, 17, 14

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