

Physics, Abstraction and Computation

Code: 104402
ECTS Credits: 9

Degree	Type	Year	Semester
2503740 Computational Mathematics and Data Analytics	OB	3	1

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: spanish (spa)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: Yes

Teachers

María del Pilar Casado Lechuga

Prerequisites

There are no prerequisites.

Objectives and Contextualisation

Introduction to Physics as a paradigm of empirical science. Exemplary problems from different physical disciplines will be presented. Theories that describe them will be introduced, analyzing and justifying the abstraction that they entail. The general principles of these theories and their mathematical formulation will be identified, and the numerical methods necessary to tackle complex problems of difficult analytical solution will be presented.

Competences

- Demonstrate a high capacity for abstraction and translation of phenomena and behaviors to mathematical formulations.
- Design, develop and evaluate efficient algorithmic solutions to computational problems in accordance with the established requirements.
- Make effective use of bibliographical resources and electronic resources to obtain information.
- Plan and carry out studies of physical system using analytical or numerical methods and interpret the results.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.

- Using criteria of quality, critically evaluate the work carried out.

Learning Outcomes

1. Make effective use of bibliographical resources and electronic resources to obtain information.
2. Mathematically describe movement and identify the quantities conserved.
3. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
4. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
5. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
6. Understand physical concepts and their mathematical formulation in field theory and statistical mechanics.
7. Use numerical methods to solve problems in optics.
8. Use variational methods and disturbances and statistics to understand systems of more than two bodies, fluids and gases.
9. Using criteria of quality, critically evaluate the work carried out.

Content

1. Physical quantities: Units, precision.
2. Space and time.
3. Linear and rotational movement.
4. Force and Moment of Force: Newton's Laws.
5. Fundamental forces and effective forces.
6. Conservation principles: Work, energy, linear momentum and angular momentum.
7. Strength potential. Principle of least action. Effective potential.
8. Orbits with radial forces.
9. Orbits in magnetic fields.
10. Oscillations.
11. Electrical circuits.
12. Phase space. Partition function. Gases.
13. Fluid mechanics.
14. Light. Physical and Geometric Optics.

Methodology

Notice: The proposed teaching methodology and assessment may be subject to change depending on attendance restrictions imposed by health authorities.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Exercise resolution sessions	35	1.4	9, 6, 2, 3, 4, 7, 8
In-depth seminars	5	0.2	6, 2, 5, 1, 7, 8
Theory Classes	35	1.4	6, 2, 5, 1, 7, 8
Type: Autonomous			

Exercise resolution	60	2.4	9, 6, 2, 3, 4, 1, 7, 8
Study	60	2.4	6, 2, 5, 4, 1, 7, 8
Tutorials with professors	20	0.8	6, 2, 7, 8

Assessment

Notice: The proposed teaching methodology and assessment may be subject to change depending on attendance restrictions imposed by health authorities.

The competences of the subject will be evaluated by the Continuous Evaluation method, which will include two types: Delivery of Exercises (individual or collective) and Continuous Evaluation Tests.

The Continuous Assessment will be carried out in a total of 7 actions distributed throughout the academic period. The actions according to the typology will be:

3 Exercises Delivery actions (individual or collective) that will have a weight of 14.0% in the final grade each.

4 Continuous Assessment Test actions that will have a weight of 14.5% in the final grade each,

Each Continuous Assessment Test will only contribute to the final grade if 35% of the maximum score of said test is reached.

Deliveries will consist of carrying out an analysis of a physical system before a deadline and summarizing said analysis in a report to be delivered in writing or by electronic means. This will allow students to demonstrate their understanding of the contents of theory and exercise solving classes and the acquisition of skills.

The Tests will consist of solving exercises and / or answering questions in writing or by telematic means, in person or by telepresence, with a limited time. This will allow students to demonstrate their understanding of the contents of theory and exercise solving classes and the acquisition of skills.

The place, time and date of the Continuous Assessment Tests will be announced through the Moodle Classroom at least one week in advance. Also, the place, time and date to deliver the Individual Delivery will be announced through the Moodle Classroom at least one week in advance.

The place, time and date of the review of the results of the Continuous Assessment Tests will be announced through the Moodle Classroom 48 hours in advance.

The condition to pass the course will be to obtain at least 50% of the maximum score.

The matrícula de honor grade will be assigned, within the allowed quotas, to students who demonstrate a very high academic performance sustained throughout the academic period.

The Non-Assessable condition will be applied to students who do not take any of the Continuous Assessment Tests without just cause.

The correction of the Continuous Assessment Tests and the Deliveries will take into account the correct application of the contents of the subject to solve the proposed exercises and also the way in which the solutions and results are presented. In particular, solutions will be required to be presented in an orderly manner, with an appropriate level of detail, and to follow a logical flow of resolution.

Without prejudice to other disciplinary measures deemed appropriate, and in accordance with current academic regulations, irregularities committed by the student that may lead to a variation in the grade of an act of evaluation will be rated with a zero. Therefore, copying or letting a practice or any other evaluation activity be copied will involve suspending with a zero, and if it is necessary to pass it to pass, the whole subject will be suspended. The evaluation activities classified in this way and by this procedure will not be recoverable, and therefore the subject will be directly suspended without the opportunity to recover it in the same academic year.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Continuous Assessment Tests	58	5	0.2	9, 6, 2, 5, 3, 4, 7, 8
Delivery of exercises (individual or collective)	42	5	0.2	6, 2, 5, 3, 4, 1, 7, 8

Bibliography

Any text of Introduction to Physics at the university level is suitable for the subject. Volumes 1 and 2 of the following bibliographic reference are taken as the standard reference:

AUTOR: Tipler, Paul Allen

TITOL: Física : para la ciencia y la tecnología / Paul A. Tipler, Gene Mosca

EDICIO: 6ª ed.

PUBLICACIO: Barcelona [etc.] : Reverté, 2010

ISBN: 9788429144291 (v. 1) (Vol. 1. Mecánica, oscilaciones y ondas, termodinámica) 9788429144307 (v. 2) (Vol. 2. Electricidad y magnetismo / Luz)

NOTE: Electronic version in Catalan available through the UAB Library.