Universitat Autònoma de Barcelona

2019/2020

History of Physics

Code: 100170
ECTS Credits: 6

Degree	Type	Year	Semester
2500097 Physics	OT	4	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

The subject does not require to have taken any specific subjects of the degree.

Objectives and Contextualisation

The subject deals with the past and present of Physics with 4 aims:
1. To describe the main changes in the structure, methods and concepts of Physics.
2. To identify the different ways of practising Physics, taking into account the institutional structure of the discipline.
3. To analize the social, cultural, and gender relations of Physics.
4. To recognize the historical sources of Physics and the methodological problems that they pose.
The subject also has the general aim of improving the student's capacity to advance and contrast arguments.

Competences

- Carry out academic work independently using bibliography (especially in English), databases and through collaboration with other professionals
- 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 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
- Generate innovative and competitive proposals for research and professional activities.
- Know the fundamentals of the main areas of physics and understand them
- Respect the diversity and plurality of ideas, people and situations
- 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. Chronologically and thematically locate the concepts and practices that lead to the development of quantum mechanics.
2. 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.
3. Describe and analyse Einsteins physical arguments and his way of presenting them.
4. Describe and analyse Galileo's demonstration of the law of falling bodies and characterise its mathematisation of movement.
5. Describe and analyse the contribution of Galileo to the establishment of a mathematical and experimental physics.
6. Describe and analyse the reaction of the public and the scientific community to Einstein's visit to Spain in 1923.
7. Describe the changes in the methods and tools of physics, concerning the division of the discipline into different areas.
8. Describe the contribution of Newton to the use of mathematics in natural philosophy.
9. Describe the origins of the concept of field.
10. Describe the problems raised by the use of instruments in natural philosophy.
11. Describe the relationship between the theory of relativity and the problems of the electrodynamics of moving bodies.
12. Described the Platonic attitude to the mathematical foundations of physical reality.
13. Develop an understanding of the structure and content of the mathematical principles in natural philosophy of Isaac Newton.
14. Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
15. Develop independent learning strategies.
16. Distinguish the different stages of formation in the main areas of physics, in addition to the reasons for their grouping into categories such as Aristotelian physics, geocentric physics, Newtonian physics, classical physics and modern or contemporary physics.
17. Explain the challenge of mathematising electricity in the Enlightenment, from an analysis of the experimental demonstration of the law of force between charged objects.
18. Explain the relationship between Galilean kinematics and Copernican cosmology.
19. Explain the relationship between these factors and their impact on the practice of physics and the genesis of the laboratory.
20. Explain the sense in which Hertz states that Maxwells theory is Maxwells system of equations.
21. Generate innovative and competitive proposals for research and professional activities.
22. Identify the factors that lead to the professionalisation of research and the teaching of physics in the nineteenth century, especially in France and Germany.
23. In an efficient way, synthesize and present the classic and historical text of physics.
24. Participate in discussions that contrasts different views on the historical significance of a text or a problem of physics.
25. Recognise the main stages in the development of contemporary physics in Spain and Catalonia.
26. Recognize the different traditions that shaped the genesis of electromagnetic theory.
27. Recognize the original meaning of the term physics.
28. Recognize the relationship between physics, philosophy and culture throughout history.
29. Respect diversity in ideas, people and situations.
30. Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments
31. Work independently, take initiative itself, be able to organize to achieve results and to plan and execute a project.
32. Working in groups, assume shared responsibilities and interact professionally and constructively with others, showing absolute respect for their rights.
33. Carry out academic work independently using bibliography (especially in English), databases and through collaboration with other professionals

Content

The contents are grouped in two chronological parts. The first one deals with the rise of classical physics, from Antiquity through the Enlightenment; the second deals with the development of contemporary physics.

Part 1

1 Introduction: physics and history

2 *Physis*, movement and cosmology

3 The astronomical revolution

4 Newton and *The Mathematical Principles of Natural Philosophy*

5 Electricity and Enlightened physics

Part 2

6 The birth of a discipline: classsical physics

7 The new physics: mattter, energy and radiation

8 The quantum and relativistic revolutions

9 Physics, gender, and society in the 20th century

10 Physics in Spain and Catalonia

Methodology

Theoretical classes: We develop a topic every week. The presentation is made available to the students through the virtual Campus (Aula Moodle).

Practical classes: The practical sessions of the subject are devoted to the analysis and the commentary of short texts, collected in dossiers available to students. This activity may be compared to the resolution of problems, because the texts deal with physics but alsol because texts produced in different historical contexts pose fundamental questions on the subject (such as conceptual and methodological changes in physics).

Personal work: Guided reading of texts, elaboration of an essay review with clear guidelines.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical lecture	16	0.64	2, 15, 14, 16, 33, 24, 30, 28, 29, 23, 32
Theoretical lecture	33	1.32	7, 9, 10, 3, 5, 4, 6, 12, 8, 11, 16, 17, 20, 19, 18, 13, 22, 27, 26, 25, 28, 1
Type: Autonomous			
Personal work by the student	52	2.08	16, 28, 23
Preparation of written essays and essay review	46.5	1.86	2, 15, 14, 16, 33, 21, 24, 30, 28, 29, 23, 31, 32

Assessment

The exam of Part I consists of questions that we will have been raised and in the practiceal sessions. The exam is done without notes or dossiers, during the week scheduled for partial exams.

Written essays of both parts. For each topic, we will raise questions related to the readings proposed in the Moodle classroom. You must write an essay of 600 words on any of these questions. Prepare the text for discussion in the classroom on the indicated dates. You can choose the question or questions, and complete, review or annotate this text during the discussion. You will present the texts online through the Moodle Classroom, within the term indicated for each delivery.

The exam of Parrt II consists of an essay review of a text about the history of contemporary physics (xix-xx centuries). The essay should be between 1,500 and 1,800 words long and should clearly outline the main ideas of the chosen text and its significance for the history of physics. The Moodle Classroom proposes the texts that can be the subject of the review, which deal with the physics of the 19th and 20th centuries and are related to the topics of Part II.

There will be a reevaluation exam, with a total maximum weight of 60%. To be reevaluated, you must have been evaluated in a set of activities whose weight equals to a minimum of two thirds of the total grade of the subject.

The student will be deemed NOT AVALUABLE if he has not participated in all the assessment activities.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Essay review part II	30%	0	0	2, 7, 9, 3, 6, 11, 16, 20, 19, 33, 22, 30, 26, 25, 28, 1, 31, 32
Essays	40%	0	0	2, 15, 14, 33, 21, 24, 30, 27, 28, 29, 23, 31, 32
Exam part I	30%	2.5	0.1	7, 10, 5, 4, 12, 8, 16, 17, 18, 13, 27
Reevaluation	60%	0	0	7, 9, 10, 3, 5, 4, 6, 12, 8, 11, 15, 14, 16, 17, 20, 19, 18, 13, 22, 30, 27, 26, 25, 28, 1

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General references

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Astronomical revolution and newtonianism

COHEN, I. Bernard (1985). El nacimiento de una nueva física. Madrid: Alianza, 1989.

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