UAB
Universitat Autònoma de Barcelona

History of Physics

Code: 100170
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500097 Physics	OT	4
2504235 Science, Technology and Humanities	OT	4

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Teachers

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Teaching groups languages

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

Prerequisites

There are none.

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 doing Physics.
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

Physics

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- 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 strategies for analysis, synthesis and communication that allow the concepts of physics to be transmitted in educational and dissemination-based contexts
- Know the fundamentals of the main areas of physics and understand them
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
- 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.

Science, Technology and Humanities

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Analyse questions related to science and technology in society, using basic, essential forms of mathematical and statistical reasoning.
- Construct discourse on scientific and technical knowledge using the linguistic resources of argument.
- Display a capacity for organisation and planning and, at the same time, for adapting to new problems or situations.
- Identify the various philosophical, ethical and sociological conceptions of science and technology and recognise their evolution throughout history.
- Recognise and interpret the elements that integrate the material and visual culture of science and technology into the different stages of its development.
- Recognise the political, social and cultural dimension of science and technology development in the different historical periods.
- 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 be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.

Learning Outcomes

1. "Recognise the original meaning of the term ""physics"". "
2. Analyse key questions on the basis of evidence and argument, synthesising information and developing reasoned arguments based on the collection and interpretation of significant data.
3. Analyse the sex- or gender-based inequalities and the gender biases present in one's own area of knowledge.
4. Assess the impact of the difficulties, prejudices and discriminations that actions or projects may involve, in the short or long term, in relation to certain persons or groups.
5. Be able to analyse and synthesise.
6. Carry out academic assignments independently, using source materials (especially in English) and databases, and in collaboration with other professionals.
7. Chronologically and thematically locate the concepts and practices that lead to the development of quantum mechanics.
8. Collect and interpret data on which to substantiate the conclusions drawn, including, where necessary, a reflection on social, scientific or ethical matters in the field of humanities.
9. Communicate complex information clearly and precisely, whether orally, in writing or by using ICT, to specialist and non-specialist audiences.
10. 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.
11. Communicate effectively orally and in writing.
12. Consider how gender stereotypes and roles impinge on the exercise of the profession.
13. Critically follow the arguments exposed by others.

14. Describe and analyse Einstein's physical arguments and his way of presenting them.
15. Describe and analyse Galileo's contribution to the establishment of a mathematical and experimental physics.
16. Describe and analyse Galileo's demonstration of the law of falling bodies and characterise its mathematisation of movement.
17. Describe and analyse Galileo's demonstration of the law of the fall of weights and characterise the mathematisation of movement.
18. Describe and analyse the contribution of Galileo to the establishment of a mathematical and experimental physics.
19. Describe and analyse the reaction of the public and the scientific community to Einstein's visit to Spain in 1923.
20. Describe and analyse the reaction of the public and the scientific community to Einstein's visit to Spainin 1923.
21. Describe the changes in the methods and instruments of physics, in relation to the division of the discipline into different areas.
22. Describe the changes in the methods and tools of physics, concerning the division of the discipline into different areas.
23. Describe the contribution of Newton to the use of mathematics in natural philosophy.
24. Describe the origins of the concept of field.
25. Describe the problems posed by the use of instruments for natural philosophy.
26. Describe the problems raised by the use of instruments in natural philosophy.
27. Describe the relationship between the theory of relativity and the problems of electrodynamics of bodies in movement.
28. Describe the relationship between the theory of relativity and the problems of the electrodynamics of moving bodies.
29. Described the Platonic attitude to the mathematical foundations of physical reality.
30. Described the Platonic attitude to the mathematical substantiation of physical reality.
31. Develop an understanding of the structure and content of the mathematical principles in Isaac Newton's natural philosophy.
32. Develop an understanding of the structure and content of the mathematical principles in natural philosophy of Isaac Newton.
33. Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
34. Develop independent learning strategies.
35. Develop self-directed learning.
36. Devise mathematical strategies and objects to address new problems or challenges in different areas of mathematics itself or in science in general and society.
37. Display advanced knowledge and understanding of theory and practice and of the work methodologies specific to the humanities, thus achieving a high level in knowledge generation.
38. Distinguish the different stages of education in the main areas of physics, and the reasons for their grouping into categories like Aristotelian physics, geocentric physics, Newtonian physics,classical physics and modern or contemporary physics.
39. 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.
40. Explain the challenge of mathematising electricity in the Enlightenment, from an analysis of the experimental demonstration of the law of force between charged objects.
41. Explain the explicit or implicit code of practice of one's own area of knowledge.
42. Explain the relationship between Galilean kinematics and Copernican cosmology.
43. Explain the relationship between these factors and their impact on the practice of physics and the arrival of the laboratory.
44. Explain the relationship between these factors and their impact on the practice of physics and the genesis of the laboratory.
45. Explain the sense in which Hertz states that Maxwell's theory is Maxwell's system of equations.
46. Gain access to the sources, concepts and theories needed to approach studies in the areas of this degree.
47. Generate innovative and competitive proposals for research and professional activities.
48. Identify situations in which a change or improvement is needed.

49. Identify the factors that lead to the professionalisation of research and the teaching of physics in the nineteenth century, especially in France and Germany.
50. In an efficient way, synthesize and present the classic and historical text of physics.
51. Integrate elements from different areas of knowledge to analyse a situation and suggest actions or solutions.
52. Know that in the past, an illicit use of genetics has been made to promote racist ideologies.
53. Know the scientific and technological developments achieved in Asia and Africa throughout history, from the third millennium before the Common Era up to the present day.
54. Participate in discussions that contrasts different views on the historical significance of a text or a problem of physics.
55. Present a map of technological and scientific knowledge with its debts and contributions between the various forms of science and technology.
56. Question ethical problems in the Arab and Islamic world and East Asia, and reconsider humanistic values in our society, concerning social and moral engagement.
57. Reason critically, show analytical skills, use technical language correctly and formulate logical arguments.
58. Reason critically.
59. Recognise the cultures that have developed in Asia and Africa, attaching importance to the different forms of knowledge and action that have arisen there.
60. Recognise the main stages in the development of contemporary physics in Spain and Catalonia.
61. Recognise the relationships between physics, philosophy and culture throughout history.
62. Recognize the different traditions that shaped the genesis of electromagnetic theory.
63. Recognize the original meaning of the term physics.
64. Recognize the relationship between physics, philosophy and culture throughout history.
65. Respect diversity in ideas, people and situations.
66. Synthesize, based on the historical advance of genetics, a perspective of the current and future scope of this science.
67. Take part in discussions in which different points of view regarding the historical significance of a physics text or problem are played off against each other.
68. Through personal arguments or procedures, apply the knowledge acquired and the ability to solve problems to complex situations concerning the humanities, including specialist professional activities that require creative, innovative ideas.
69. Use and manage bibliographic information, or computer- or internet-based resources within the area of study, in the first languages and in English.
70. Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments
71. Work independently, take initiative itself, be able to organize to achieve results and to plan and execute a project.
72. Working in groups, assume shared responsibilities and interact professionally and constructively with others, showing absolute respect for their rights.
73. 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 to 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 relativistic revolution
9. The quantum revolution
10 Physics, gender, and society in the 20th century

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical lectures	16	0.64	10, 39, 50, 54, 64, 70, 72, 73
Theoretical lectures	33	1.32	7, 14, 16, 18, 19, 22, 23, 24, 26, 28, 29, 32, 39, 40, 42, 44, 45, 49, 60, 62, 63, 64
Type: Autonomous			
Personal work	52	2.08	39, 50, 64
Preparation of essays and essay review	46.5	1.86	10, 39, 50, 54, 64, 70, 71, 72, 73

Theory lectures: Presentation of each theme (aims, contents, related texts). The presentation will be available at the Aula Moodle.
Practical lectures: Discussion of the theme's readings, available at the Aula Moodle.
Personal work: Guided reading of texts, study, elaboration of essays and essay review.

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

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Essay review part 2	30%	0	0	7, 10, 14, 19, 22, 24, 28, 39, 44, 45, 49, 60, 62, 64, 70, 71, 72, 73
Essays	40%	0	0	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73
Exam	30%	2.5	0.1	16, 18, 22, 23, 26, 29, 32, 39, 40, 42, 63

Exam part 1. The exam will be based on the questions proposed in the Campus virtual and will refer to the texts and images discussed. The student will have to identify and explain the historical significance of some of these texts or images.
Essays. For each topic, we will raise questions related to the readings proposed in the Moodle classroom. The student will write five essays of up to 600 words on any of these questions, and submit them through the Aula Moodle. The readings will be discussed in the classroom.
Essay review part 2. consists of an essay review of a text about the history of contemporary physics. The essay will be 2000 words long and can be a two-person essay. It 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 and provides additional indications.

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.

One-off assessment. The student who has taken up the One-off Assessment mode will do a final test that will consist of an exam on Part 1 (30%) and the submission of the 5 assays and the review of Part 2. This test will be held on the same day, time and place as the tests for the second part of the continuous evaluation mode.

In the event of a student committing any irregularity that may lead to a significant variation in the grade awarded to an assessment activity, the student will be given a zero for this activity. In the event of several irregularities in assessment activities of the same subject, the student will be given a zero as the final grade for this subject.

Bibliography

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Software

No specific software is required.

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Catalan	second semester	morning-mixed
(TE) Theory	1	Catalan	second semester	morning-mixed