Universitat Autònoma de Barcelona

2022/2023

Current Science Topics

Code: 100092
ECTS Credits: 6

Degree	Type	Year	Semester
2500097 Physics	FB	1	A
2500149 Mathematics	FB	1	A
2500250 Biology	OT	4	A
2500502 Microbiology	OT	4	A
2500890 Genetics	OT	4	A
2501915 Environmental Sciences	OT	4	A
2501922 Nanoscience and Nanotechnology	OT	4	A
2503740 Computational Mathematics and Data Analytics	OT	4	A

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

Other comments on languages

The talks are in Catalan and Spanish. 4th year students have to write and present their final project in English. Some assignments are in English.

Teachers

Ramón Muñoz Tapia

Gael Sentís Herrera

Prerequisites

There are no prerequisites.
It is recommended, however, a certain familiarity with the computer environment since many of the activities will be done virtually through the Moodle classroom and the virtual campus, in particular basic knoewledge of mathematical text processing programs, creation of graphics, generation of documents in PDF etc. is advised.

Objectives and Contextualisation

This subject is taught simultaneously as a first-year subject (compulsory) in the Mathematics and Physics degrees, and as a fourth year subject (optional) in the Degrees of Computational Mathematics and Analytical Data of Chemistry, Environmental Sciences, Nanoscience and Nanotechnology (of the faculty of Sciences) and in the degrees of Biology, Microbiology and Genetics (of the Faculty of Biosciences).

The training objectives are the same, but there will be aspects of the subject (type of work, assessments ...) that may be different depending on the course (wether is the first or the fourth) and the degree followed by the student.

Training objectives:

Expand the vision and interest of the student towards different fields of science, beyond the specialty they are studying.

Acquire an interdisciplinary vision of science.

Analyze and reflect on the relationships between science, gender, culture and society.

Provide the student basic understanding of frontier topics in current science, presented in a pedagogical and accessible manner.

Acquire transversal competences.

Learn how to write a scientific work that complies with formal quality standards and know how to expose it in public.

Reflect on the nature of science.

Competences

Physics

- Develop the capacity for analysis and synthesis that allows the acquisition of knowledge and skills in different fields of physics, and apply to these fields the skills inherent within the degree of physics, contributing innovative and competitive proposals.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- 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

Mathematics

- Actively demonstrate high concern for quality when defending or presenting the conclusions of one's work.
- Apply critical spirit and thoroughness to validate or reject both one's own arguments and those of others.
- Effectively use bibliographies and electronic resources to obtain information.
- Recognise the presence of Mathematics in other disciplines.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.

Biology

- Be able to analyse and synthesise
- Be able to organise and plan.
- Develop a sensibility towards environmental issues.

- 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.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.

Microbiology
- Adapt to new situations.
- Communicate orally and in writing.
- Develop creativity and initiative.
- Develop critical reasoning skills in the field of study and in relation to the social context.
- Display a capacity for analysis, synthesis, organisation, planning and decision-making.
- Display sensibility towards environmental, health and social matters.
- Ethical commitment.
- Identify and solve problems.
- Obtain, select and manage information.

Genetics
- Adapt to new situations.
- Assume ethical commitment
- Be able to communicate effectively, orally and in writing.
- Be able to organise and plan.
- Be sensitive to environmental, health and social matters.
- Develop creativity.
- Develop self-directed learning.
- Make decisions.
- Reason critically.
- Take the initiative and demonstrate an entrepreneurial spirit.
- Use and manage bibliographic information or computer or Internet resources in the field of study, in one's own languages and in English.

Environmental Sciences
- Adequately convey information verbally, written and graphic, including the use of new communication and information technologies.
- Analyze and use information critically.
- Demonstrate concern for quality and praxis.
- Demonstrate initiative and adapt to new situations and problems.
- Information from texts written in foreign languages.
- Integrate physical, technological and social aspects that characterize environmental problems.
- Learn and apply in practice the knowledge acquired and to solve problems.
- Teaming developing personal values regarding social skills and teamwork.
- Work autonomously

Nanoscience and Nanotechnology
- Adapt to new situations.
- Be ethically committed.
- Communicate clearly in English.
- Demonstrate knowledge of the concepts, principles, theories and fundamental facts related with nanoscience and nanotechnology.
- Lead and coordinate work groups.
- Learn autonomously.
- Manage the organisation and planning of tasks.
- Obtain, manage, analyse, synthesise and present information, including the use of digital and computerised media.
- Reason in a critical manner

- Recognise the terms used in the fields of physics, chemistry, biology, nanoscience and nanotechnology in the English language and use English effectively in writing and orally in all areas of work.
- Resolve problems and make decisions.
- Show initiative and an enterprising spirit.
- Work correctly with the formulas, chemical equations and magnitudes used in chemistry.

Computational Mathematics and Data Analytics

- Apply a critical spirit and rigour for the validation or rejection of your own arguments and those of others.
- Demonstrate a high capacity for abstraction and translation of phenomena and behaviors to mathematical formulations.
- Make effective use of bibliographical resources and electronic resources to obtain information.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Using criteria of quality, critically evaluate the work carried out.

Learning Outcomes

1. Acquire keys for a knowledge and basic understanding of frontier topics in current science, presented in an informative manner.
2. Actively demonstrate high concern for quality when defending or presenting the conclusions of one's work.
3. Adapt to new situations.
4. Adequately convey information verbally, written and graphic, including the use of new communication and information technologies.
5. Analyze and use information critically.
6. Apply a critical spirit and rigour for the validation or rejection of your own arguments and those of others.
7. Apply critical spirit and thoroughness to validate or reject both one's own arguments and those of others.
8. Assume ethical commitment
9. Be able to analyse and synthesise.
10. Be able to communicate effectively, orally and in writing.
11. Be able to organise and plan.
12. Be ethically committed.
13. Be sensitive to environmental, health and social matters.
14. Carry out bibliographical searches on scientific subjects, assessing the reliability of sources.
15. Communicate clearly in English.
16. Communicate orally and in writing.
17. Demonstrate concern for quality and praxis.
18. Demonstrate initiative and adapt to new situations and problems.
19. Demonstrate wide-ranging vision and interests in different scientific ambits, showing an interdisciplinary perspective.
20. Develop a sensibility towards environmental issues.
21. Develop creativity and initiative.
22. Develop creativity.
23. Develop critical reasoning skills in the field of study and in relation to the social context.
24. Develop self-directed learning.
25. Display a capacity for analysis, synthesis, organisation, planning and decision-making.
26. Display sensibility towards environmental, health and social matters.
27. Draft reports on the subject in English.
28. Effectively use bibliographies and electronic resources to obtain information.
29. Ethical commitment.
30. Expand the vision and the interest of the student to different fields of the science, stimulating an interdisciplinary prospect.
31. Identify and solve problems.
32. Identify the main inequalities and discriminations in terms of sex/gender present in society.
33. Identify the main topics of modern-day science.

34. Identify the major debates in current scientific thinking.
35. Identify the principal forms of sex- or gender-based inequality and discrimination present in society.
36. Identify the social, economic and environmental implications of academic and professional activities within one's own area of knowledge.
37. Information from texts written in foreign languages.
38. Know the main debates of current scientific thinking, especially regarding the environment.
39. Lead and coordinate work groups.
40. Learn and apply in practice the knowledge acquired and to solve problems.
41. Learn autonomously.
42. Make decisions.
43. Make effective use of bibliographical resources and electronic resources to obtain information.
44. Manage the organisation and planning of tasks.
45. Obtain, manage, analyse, synthesise and present information, including the use of digital and computerised media.
46. Obtain, select and manage information.
47. Present brief reports on the subject in English.
48. Present, discuss and transmit (orally or in writing) opinions on scientific subjects.
49. Propose projects and actions that incorporate the gender perspective.
50. Purchase keys for the knowledge and basic understanding of subjects of border in the current science, presented with divulgation character
51. Reason critically.
52. Reason in a critical manner
53. Reporting on scientific issues in other specialist areas with objectivity and originality.
54. Resolve problems and make decisions.
55. Show initiative and an enterprising spirit.
56. 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.
57. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
58. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
59. Take the initiative and demonstrate an entrepreneurial spirit.
60. Teaming developing personal values regarding social skills and teamwork.
61. Use and manage bibliographic information or computer or Internet resources in the field of study, in one's own languages and in English.
62. Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments
63. Using criteria of quality, critically evaluate the work carried out.
64. Work autonomously
65. Work correctly with the formulas, chemical equations and magnitudes used in chemistry.

Content

The subject is structured around a series of conferences given by renowned specialists in different subjects. The topics of the conferences are

- Curie and Einstein: science and society
- Genomics and climate change
- Mathematical models of Covid
- Planets beyond the Solar System
- Blockchain and crypto-coins
- Paradoxical games
- Science and gender
- Ultra-fine atoms
- Molecules that heal
- Climate change
- Nanotechnology for biosensors

Methodology

Presential learning activities

- Conferences (master classes). They are usually held in the Main Conference room of the faculty by a guest specialist. Attendance is mandatory, except in cases justified detailed in the section on evaluation. In the latter case, since the lectures will be recorded in video, they can be viewed from the Moodle classroom. The materials of the conference (PowerPoint files, links ...) will also be accessible via Moodle where they can be consulted by all students. For non-presencial students attendance to the lectures is optional.

- Seminars (complementary sessions for discussion and preparation of work). They will be open sessions of discussion and / or debate that will be held the week after the conference. The professor will also present the bibliography and proposals for topics for the preparation of the final work. Attendance at the seminars is highly recommended, since it will facilitate the preparation of the student's portfolio, and in any case, at least, at least, the attendance at the session on which the student will have chosen to do will be compulsory the final work Exceptionally, the non-attendance students who are unable to attend them can arrange a personal interview with the teachers to prepare the final work in schedule to be agreed. These sessions may also be registeredand and available in the campus virtual.

Supervised learning activities
Preparation of a portfolio. Throughout the course, students will have to periodically deliver a series of activities and / or exercises and problems about the subjects covered in the conferences during the Moodle classroom. These deliveries (obligatory in all cases) will constitute the student's portfolio, a collection of the evidence of the student's learning. These tasks may be different for the first and fourth year students, adapting to their level of knowledge.

Final work

The student will have to prepare a final work, compulsorily made in a group (of 3 or 4 people), on one of the topics proposed in the seminars of the conferences. The work will be supervised by the lecturer and the teachers of the subject. In the case of fourth year students, the work can not be done on the subjects directly related to the degree that the student is studying, and must be drafted and presented in English. All the works will be presented in a public session in front of a committee of professors. In especial cases of students abroad remote presentation can be considered. This course all papers will be presented at the end of the lectures during the Wednesdays of May. The presentation schedules will try to accommodate the preferences of the students, but given the organizational complexity, the proposal of the teaching team will prevail over other considerations. The dates of presentations are made public at the beginning of the course, and take into account that they do not coincide with examination periods. It is therefore the responsibility of the students to ensure that the presentation can be made during this period or otherwise inform the teachers well in advance. At the beginning of the course there will be a session where instructions will be given on how to prepare the work. A brief practical guide will also be available on the Virtual Campus.

Autonomouslearning activities
Thestudent will consult bibliography (books, scientific journals) and conduct information searches via the Internet in order to do the tasks of the student's portfolio and the final work. There will be a schedule for the tutorials in which the students will be able to contact the professors of their subject of interest to solve doubts and to keep track of the preparation of the portfolio and of the final work. Some tutorials will also focus on ICT resources for the writing of scientific texts.

15 minutes of a session will be reserved for students to answer the UAB institutional surveys.

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Conferences	24	0.96	50, 30, 7, 23, 22, 44, 34, 33, 31, 37, 59
Final project	40	1.6	3, 41, 15, 2, 17, 23, 24, 22, 44, 39, 42, 59, 10, 16, 9, 11, 4, 64, 60, 65
Seminars	24	0.96	50, 2, 17, 23, 44, 31, 37, 45, 46, 48, 10, 9, 11, 28, 61
Type: Supervised			
Portfolio	12	0.48	3, 50, 30, 5, 7, 41, 40, 8, 29, 15, 38, 2, 18, 55, 17, 23, 24, 21, 22, 47, 14, 53, 44, 34, 33, 31, 39, 12, 37, 45, 46, 42, 59, 48, 62, 51, 52, 27, 54, 10, 16, 25, 9, 11, 4, 64, 60, 65, 28, 61
Type: Autonomous			
Autonomous work	50	2	3, 50, 30, 5, 7, 41, 40, 8, 29, 15, 38, 2, 18, 55, 17, 13, 23, 24, 21, 22, 47, 14, 53, 44, 34, 33, 31, 39, 12, 37, 45, 46, 42, 59, 48, 62, 51, 52, 27, 54, 10, 16, 20, 26, 25, 9, 11, 4, 64, 60, 65, 28, 61

Assessment

Since all the training and assessment activities are around the topics of the conferences, conference attendance is, in general mandatory and it is monitored throughout the course. The timetable is organised so that the first year students of the degrees of physics and mathematics (for which the subject is compulsory) can attend the lectures without incompatibilities. 4th year students (for which the subject is optional) and all the students in second or higher enrollment that document at the beginning of the course their incompatibility to attend the lectures, will be considered as non-presencial students and will have mechanisms of differentiated evaluation.

There are three types of assessment activities:

A) Individual short objective tests (20% of the final grade). They are test type tests that will be done telematically after each conference. These tests will assess the degree of attention and understanding of the subject. Assistance to the conferences will give access to the realization of these tests. Failure to realize the tests of three or more conferences, will automatically lead to the "not presented" qualification. In case of duly justified absences (up to a maximum of three), the corresponding activity will be authorized in the same way as non-presencial students as detailed below.

Non-presencial students must follow lectures via the recordings and materials of the Virtual Campus and perform a specific test about them for the Moodle classroom. Students must follow all the lectures and answer all the tests. The non-completion of more than three tests will automatically lead to the "not presented" qualification for both face-to-face and non-contact students.

B) Student portfolio (35% of the finalgrade). The student will have to update a virtual portfolio in theMoodle classroom, where they will receive the deliveries of the exercises and compulsory activities that will be proposed duringthe course. There will also be a selection of materials thatwill show your involvement in the

discussion sessions of the conferences, where your personal opinions and searches are reflected. Depending on the type of exercise proposed, cross-curricular skills such as critical thinking, autonomous learning, the ability to analyze and synthesize, etc. will be valued. and may be different for first and fourth year students, adapting to their level of studies.

C) Final work (45% of the final mark) Each student will have to participate in the preparation of a final work, compulsorily drafted in groups of between three and four students, to choose among those that will be proposed by the teachers of the different sessions This work must be submitted in writing (via Virtual Campus) within the marked periods and must conform to the formal and content characteristics of a scientific work, fulfilling the criteria that will be presented at the beginning of the course in a specific informational session. In the case of fourth year students, this work must be written in English, with the structure of a scientific research article and can not be done on the subjects directly related to the degree that the student is studying. The report and presentation must show that the group has deepened in the topic of the work, merely descriptive works with superficial contents will be undervalued.

Throughout the course there will be several public sessions of presentations, on dates that will be announced in the calendar of sessions. All the members of the group have to present a roughlyequally weighted part of the project. The evaluation will be done by a committee of professors that will assess the capacity of communication, the capacity of organization, etc. The timetable for the presentation sessions will try to ensure that all students can make the presentation, which isstrictly compulsory. For students abroad remote presentation can be arranged.

This course all the works will be presented at the end of the conferences during the Wednesdays of the month of May. The presentation schedules will try to accommodate the preferences of the students, but the proposal of the team of the subject will prevail over other considerations, as it is explained in the section of methodology. In any case, it is the responsibility of the students to ensure that the presentation can be made during this period or otherwise, notify the team well in advance. All students must submit their work before the presentation period (end of April) on a date that will be duly announcedat the beginning of the course.

The qualification of the final work will take into account both the submitted text and the presentation and the mark can not be less than 4 to beable to pass the course.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Final Project	0,45	0	0	3, 50, 1, 30, 5, 6, 7, 41, 40, 63, 15, 38, 2, 18, 55, 17, 13, 19, 23, 24, 21, 22, 47, 14, 53, 44, 34, 33, 31, 36, 35, 32, 39, 37, 45, 46, 42, 59, 48, 49, 58, 57, 56, 62, 52, 27, 54, 10, 16, 20, 26, 25, 9, 11, 4, 64, 60, 65, 28, 43, 61
Portfolio	0,35	0	0	3, 50, 1, 30, 5, 7, 41, 40, 8, 63, 29, 15, 38, 2, 18, 55, 17, 13, 23, 24, 21, 22, 47, 14, 53, 44, 34, 33, 31, 35, 32, 39, 12, 37, 45, 46, 42, 59, 48, 49, 58, 57, 56, 62, 51, 52, 27, 54, 10, 16, 20, 26, 25, 9, 11, 4, 64, 60, 65, 28, 61
Review tests	0,2	0	0	3, 50, 1, 30, 7, 41, 38, 18, 17, 13, 19, 23, 24, 44, 34, 33, 31, 35, 32, 37, 45, 46, 42, 49, 62, 51, 27, 54, 10, 25, 9, 11, 4, 64, 60, 28, 61

Bibliography

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The bibliography of each specific subject will be given in the complementary or seminar session of the corresponding conference.

The transparencies of the conferences will be available at the Virtual Campus.

For advice on the writing of scientific articles see (for example): Cargill, Margaret and O'Connior, Patrick. Writing scientific research articles: strategy ans steps. Wiley-Blackwell, 2009

Software

For the wriiting of the memory project of some of the course topics, it may be convenient to use the word processor LaTeX.

Some final work may need specific software that, naturally, will be made available to students.