Universitat Autònoma de Barcelona

2020/2021

Radiation and Materials Physics

Code: 102850
ECTS Credits: 6

Degree	Type	Year	Semester
2501915 Environmental Sciences	OB	2	2

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: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Sarah Paradis Vilar
Valenti Rodellas Vila

Prerequisites

Although there are no prerequisites for taking the subject, it is recommended to have taken pre-padeutic physics courses upon entering university as well as having passed the first-year physics subject.

Objectives and Contextualisation

Modern Physics is part of the basic fundamentals that a student of the Faculty of Sciences must acquire during their training. It represents one of the basic and obligatory training subjects for a student who wants to study the degree of Environmental Sciences. The main purpose of this subject, as well as all the subjects that make up the basic training block, is to provide students with the knowledge and primary analytical and methodological tools to develop transversal competencies in the area of Environmental Science studies. This part of Physics, developed mainly during the first part of the 20th century, is Quantum Physics, Relativity and the Structure of Matter. The aim of the course is to provide the CCAA student with the basic concepts of these subjects focusing on the structure of Matter, the Physics of Ionising Radiations and the applications of Radioactivity to the CCAA and other sectors (Energy, Research, Industry, BioMedicine). The aim of the course is that the student may be able to face numerical problems that may arise within their field of professional activity.

Competences

- Adequately convey information verbally, written and graphic, including the use of new communication and information technologies.
- Analyze and use information critically.
- Collect, analyze and represent data and observations, both qualitative and quantitative, using secure adequate classroom, field and laboratory techniques

- Demonstrate adequate knowledge and use the most relevant environmental tools and concepts of biology, geology, chemistry, physics and chemical engineering.
- Demonstrate concern for quality and praxis.
- Demonstrate initiative and adapt to new situations and problems.
- Learn and apply in practice the knowledge acquired and to solve problems.
- Quickly apply the knowledge and skills in the various fields involved in environmental issues, providing innovative proposals.
- Teaming developing personal values regarding social skills and teamwork.
- Work autonomously

Learning Outcomes

1. Adequately convey information verbally, written and graphic, including the use of new communication and information technologies.
2. Analyze and use information critically.
3. Compare the interactions between electromagnetic radiation and neutrons with matter.
4. Demonstrate concern for quality and praxis.
5. Demonstrate initiative and adapt to new situations and problems.
6. Distinguish the main elements of atomic physics.
7. Identify the main sources of natural and artificial radioactivity.
8. Identify the physical processes in the surrounding environment and evaluate them properly and originally.
9. Learn and apply in practice the knowledge acquired and to solve problems.
10. Observe, recognize, analyze, measure, and so properly and safely represent physical processes applied to environmental sciences.
11. Teaming developing personal values regarding social skills and teamwork.
12. To determine the effects of radiation on organisms and ecosystems.
13. Work autonomously

Content

PROGRAM

- Introduction
- Structure of matter and atomic radiation
- Nuclear structure
- Radioactive decay
- Sources of radioactivity
- Interaction of radiation with matter
- Magnitudes
- Biological effects of radiation
- Radiation Protection
- Applications The nuclear fuel cycle
- Radioactive Waste Management
- Industrial Applications
- Environmental Applications

Methodology

The methodology that will be carried out in the subject is the combination of directed, supervised and autonomous tasks. Theoretical classes will consist of ICT-supported master classes with notes provided by the responsible lecturer. The theory lectures will be complemented with tutorials, problem lectures and experimental practices both at the level of directed activity and supervised activity. The autonomous activities that it will be necessary for the student to carry out will consist of complementing the information approved by

the responsible lecturer, obtaining information to carry out the practices and solving problems. A bibliographic work will be carried out on a current subject related to the subject or some activities will be carried out in the classroom to ponder the final grade of the subject.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practices	6	0.24	2, 4, 13, 11
Problems lectures	10	0.4	9
Theory lectures	38	1.52	3, 12, 6, 8, 7, 10
Type: Autonomous			
Laboratory practices preparation	30	1.2	2, 9, 5, 4, 10, 1, 13, 11
Problems resolution	19	0.76	2, 9, 5, 13, 11
Study and information research	47	1.88	3, 12, 6, 8, 7, 13

Assessment

The competences of this subject will be evaluated in two parts:

- Continuous evaluation:

The continuous evaluation will be based on the evaluation from two partial tests and laboratory practices. The two partial tests will add up to 70% of the final grade of the course (35% per partial), while the laboratory practice will represent 20% of the final grade. The partial tests will be composed of a test part, a theory question and one / two problems. In order to pass the subject it will be necessary to add a 5 in the final grade taking into account that none of the grades must be lower than 4. A group work on applications of stable and radioactive isotopes for the study of the environment will be carried out that will count 10% of the grade. Complementary activities may be carried out in the classroom to complement the normal academic activities which may add a maximum of 0.5 points to the final grade.

- Recovery:

The recovery system that will be applied for each evaluation activity, bearing in mind that no student who has not been evaluated at least 2/3 of the evaluation activities during the course may be submitted for recovery. Students who have not passed either of the two partial tests with a minimum score of 4 and have not passed the subject in the continuous assessment must take the final test. The final exam consists of two parts corresponding to each part of the course. Those students who have not passed the subject because they have one of the suspended partials may only take the recovery of one of the partials. The final exam will represent 70% of the final grade. Those students who have failed the internship will have to take a supplementary internship exam on the same day as the exam. The partial tests will consist of a test part, a theory question and one or two problems.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Group work	10%	0	0	2, 9, 4, 8, 7, 1, 13, 11

Practices	20%	0	0	2, 9, 5, 4, 10, 1, 13, 11
Problems	20%	0	0	9
Theoretical test	50%	0	0	9, 3, 12, 6, 8, 7, 1

Bibliography

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- Eisberg, R. i Resnick, R. (1991) Física cuántica átomos, moléculas, sólidos, núcleos y partículas, Limusa, Méjico.
- French, A.P. (1978) *Relatividad Especial*, Ed. Reverté, Barcelona.
- Krane, K.S. (1988) *Introductory Nuclear Physics*, John Wiley & Sons, New York.
- Knoll, G.F. (1989) *Radiation Detection and Measurement*, John Wiley & Sons, New York.
- Ortega, M.R., Vidal-Quadras, A. i Villar, A. (1987) *Elementos de Radioprotección,* Universidad Autónoma de Barcelona, Bellaterra.
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