COURSE DATA

Data Subject	
Code	33069
Name	Physics
Cycle	Grade
ECTS Credits	6.0
Academic year	2024 - 2025

Study (s)

Degree	Center	Acad. year	Period
1100 - Degree in Biology	Faculty of Biological Sciences	1	Second term
1106 - Degree in Biology	Faculty of Biological Sciences	1	Second term

Subject-matter

Degree	Subject-matter	Character
1100 - Degree in Biology	3 - Physics	Basic Training
1106 - Degree in Biology	3 - Física	Basic Training

Coordination

Name	Department
MARTINEZ TOMAS, M DEL CARMEN	175 - Applied Physics and Electromagnetism
PELLICER PORRES, JULIO	175 - Applied Physics and Electromagnetism
SANTAMARIA PEREZ, DAVID	175 - Applied Physics and Electromagnetism

SUMMARY

FOR STUDENTS ENROLLED WITH THE 2010 STUDY PLAN (OLD STUDY PLAN, IN THE PROCESS OF EXTINCTION):

DUE TO THE IMPLEMENTATION OF THE NEW PLAN OF STUDIES FOR THE DEGREE IN BIOLOGY, THIS SUBJECT IS IN THE PROCESS OF EXTINCTION AND, THEREFORE, IT IS OFFERED ONLY WITHOUT TEACHING (SD). THIS MEANS THAT THERE WILL NOT BE ANY ASSOCIATED TEACHING ACTIVITY AND THAT THE EVALUATION OF THE SUBJECT WILL BE CARRIED OUT ONLY THROUGH A THEORETICAL-PRACTICAL EXAM.

STUDENTS WHO DO NOT PASS IT IN ANY OF THE CALLS OF THE 2023-24 OR 2024-25 COURSES WILL BE OBLIGED TO ADAPT TO THE NEW PLAN TO CONTINUE THEIR DEGREE STUDIES IN BIOLOGY.

"Physics" is a course of the first year of the degree in Biology which consists of 6 ECTS and is taught in the second term.

Physics is included in the syllabus of most scientific degrees and, particularly in Biology, introduces basic concepts that allow understanding the basis of many biological processes and some of the most advanced measurement techniques. In the first year of the degree, this subject is related to others, such as "Mathematics" and "Chemistry." In more advanced years Physics allows a deeper understanding of many aspects of Plant Physiology, Animal Physiology and Palaeontology, mainly.
The experience has shown that the majority of the students reaching the first year in the area of "Life Sciences" have serious deficiencies that affect their performance in the subject of Physics. The shortcomings observed are related mainly to the subjects chosen in the options of high school.
Given this evidence, this course in Physics makes a clear the connection between physics and life sciences and includes detailed applications of physics to biological systems in each chapter. The goal is to motivate the students by demonstrating the clear relationship between these disciplines. In each of the themes, new physical magnitudes, their physical meaning and their relationship with biological systems are emphasized.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

"Physics" is structured considering a starting level of knowledge equivalent to the last year of high school. First year students of the Degree of Biology are recommended to take options including Physics and Chemistry in high school. It is also advisable to have a similar level in math courses.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1100 - Degree in Biology

- Capacidad para trabajar en grupo a la hora de enfrentarse a situaciones problemáticas de forma colectiva.
- Habilidad para argumentar desde criterios racionales.
- Capacidad para realizar una exposición oral de forma clara y coherente.
- Capacidad de construir un texto escrito comprensible y organizado.

- Capacidad para obtener la información adecuada con la que poder afrontar nuevos problemas científicos que se le planteen.
- Saber aplicar los conceptos físicos teóricos a casos prácticos de índole biológica.
- Conocer el concepto de precisión ligado con una medida y su incertidumbre.
- Conocer las unidades del SI, asignarlas correctamente y trabajar con múltiplos y submúltiplos.
- Conocer el fenómeno de elasticidad y su aplicación a muestras biológicas.
- Conocer los tipos de fluidos y las ecuaciones que los describen, con especial atención al concepto de presión hidrostática.
- Entender el carácter vectorial del campo eléctrico y magnético.
- Conocer algunos de los ámbitos biológicos en los que se dan fenómenos eléctricos.
- Conocer las leyes de reflexión y refracción y aplicarlas a la formación de imágenes a través de lentes y espejos.
- Estudiar y conocer el ojo humano desde la perspectiva de sistema óptico.
- Estudiar y conocer los instrumentos ópticos elementales (lupa y microscopio).
- Conocer los principios de la radioactividad.

1106 - Degree in Biology

- Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Interpret, analyse, evaluate, process and synthesise biological data and information by applying mathematical and statistical methods.
- Apply principles of physics, chemistry and geology to the field of biology.
- Organise, plan and manage information in a manner that allows the individual to analyse, synthesise and develop critical reasoning that can be applied to solve problems, make decisions and carry out work.

- Use scientific language, both oral and written, and be able to adapt the register to the target audience and/or readers. Use the most common foreign languages in each discipline as a vehicle for communication in a globalised system.
- Use ICTs, apps and other computer tools to manage and disseminate information in both educational and professional environments.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

Understand the basics and most important physical phenomena and their applications to biology.

• Solve academic problems related to the physical phenomena involved biology, identifying the essential elements of a situation and making the necessary approximations.

• Proper use of specific terminology of physics and development of the basic vocabulary necessary to communicate this subject.

• Ability to argue in the context of a scientific discussion.

• Identify problems and devise strategies for their resolution.

• Assess the relative importance of different causes involved in a physical phenomenon.

• Identify the essential elements of a complex situation, make the necessary approaches to construct simplified models that describe it and understand their behavior and in other situations.

• Interpret mathematical solutions in terms of physics and deduce the physical consequences of these solutions and apply them to different factual circumstances.

• Perform an update of existing information on a specific problem, sort and analyze it critically.

• Plan and organize their own continuous learning, based on individual work, from the literature and other sources.

• The supervised resolution of problems develops instrumental skills, such as "analysis and synthesis" and "troubleshooting", and by working in groups and discussing the problems, also other personal skills, such as "teamwork", "skills in personal relationships" and "critical thinking".

• The laboratory and experimental demonstrations, demand instrumental work skills, such as "analysis and synthesis", "planning and organization," the "oral and written communication in the native language" and "management of information".

• Finally, develop personal competence "working in an interdisciplinary team" through the "Interdisciplinary Seminar".

DESCRIPTION OF CONTENTS

1. Introduction

- Unit systems
- Data analysis and presentation
- Errors
- Magnitudes. Graphical analysis

2. Principles of Biomechanics

2.1. Elasticity. Hookes law.
2.2. Tension, compression. Youngs modulus. Poisson coefficient
2.3. Other strain experiments
2.4. Structural design in nature.
2.5. Hydrostatics.
2.6. Ideal fluids: Bernouilli equation.
2.7. Viscosity: Poiseuille equation.

3. Principles of Bioelectromagnetism

3.1 Electric force and electric field.
3.2 Electric potential.
3.3 Cell membrane. Capacitors.
3.4 Electric currents. Resistence.
3.5 CC circuits.
3.6 Magnetic field. Force on moving carriers.
3.7 Mass spectrometer.

4. Optics

4.1 The electromagnetic spectrum.
4.2 Refractive index. Reflexion and refraction.
4.3 Mirrors and lenses.
4.4 Image formation.
4.5 Optical instruments: magnifier and microscopy.
4.6 Human eye.
4.7 Ametropies.

5. Waves

5.1 Classification of waves.
5.2 Wave equation: wavelength, frequency and velocity.
5.3 Energy and intensity. Absorption.
5.4 Wave superposition.
5.5 Introduction to acoustics.

6. Radioactivity

6.1 Structure of the nucleus. Nuclear forces.
6.2. Mass and binding energy.
6.3 Radioactive decays.
6.4 Archeological and geological dating.
6.5 Artificial radioactivity. Applications.
6.6 Ionising radiations. Biological effects. Dose.

7. Physics Laboratory

Session 1: Scaling laws.
Session 2: Density and viscosity of a liquid.
Session 3: Electric circuits. Measurements of currents and potentials.
Session 4: Image formation by slim lenses and optical microscopy.
Session 5: Evaluation

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	35,00	100
Laboratory practices	15,00	100
Classroom practices	10,00	100
Study and independent work	28,00	0
Preparing lectures	27,00	0
Preparation of practical classes and problem	27,00	0
Resolution of online questionnaires	8,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

NOT APPLICABLE FOR STUDENTS ENROLLED WITH THE 2010 STUDY PLAN (OLD STUDY PLAN, IN THE PROCESS OF EXTINCTION) DUE TO THE IMPLEMENTATION OF THE NEW STUDY PLAN: SEE THE SUMMARY SECTION

The development of the subject in the lecture time is conducted as described in section “workload”.

• The working material will be as follows:

- An outline of the matter will be dealt with throughout the curriculum and the student must complete it with the recommended bibliography.

- A collection of problems, including: (a) some solved ones, (b) others to be solved in the classroom-in an oriented way, (c) the rest for individual work.

- Some scripts containing the basic information for the laboratory sessions.

- On line questionnaires.

• Theory classes are developed in groups of 64 students with a periodicity of two sessions per week. In each session, the lecturer will develop the thematic part, keeping cohesion, and giving the students the most appropriate resources for further development of the subject during the time of study and individual work.

• Problem solving classes are done in groups of 32 students. In them, students solve a collection problems guided by the lecturer, aiming to the application of theoretical knowledge presented in the theory classes. The resolution and discussion will take place, sometimes by the lecturer and others by the students, either individually or in groups.

• Laboratory classes are taught in groups of 16 students and sessions are structured to provide students with the rudiments of experimental method (data, error analysis, graphical representations of experimental data, presentation of results, ...) and highlight methodological aspects of physics and science in general. The lecturer responsible for the lab group will give, at the beginning of each session, a brief introduction to the content, methodology and development of the demonstration. During the session, the lecturer will guide the experience. The students should present the results of laboratory experience in a memory / abstract format indicated by the lecturer of the subject.

• The students will complete a series of multiple-choice questions in the “Aula Virtual” that are related to theoretical and practical content of the course. Each test should be performed in a given period of time fixed by the lecturer.

• Seminars are cross-cutting between the subjects of the first year of the degree. Students choose a topic from a set of topics proposed by the faculty, should make a poster and present it to the rest of the class.

EVALUATION

NOT APPLICABLE FOR STUDENTS ENROLLED WITH THE 2010 STUDY PLAN (OLD STUDY PLAN, IN THE PROCESS OF EXTINCTION) DUE TO THE IMPLEMENTATION OF THE NEW STUDY PLAN: SEE THE SUMMARY SECTION

• The on-line questionnaires will constitute 5% of the total grade. The minimum to average with the other contributions will be 4 out of 10.

• The seminar will contribute up to 10% of the final grade. The evaluation of this activity will test the ability of access to scientific information, the ability of synthesis and the ability of dissemination of scientific knowledge through a public oral presentation. The qualification will be valid for the academic year.

• A final exam consisting of short questions and problems will weight 60% of the final grade. This percentage includes the evaluation of the ability to access scientific information, the capacity of synthesis and the ability to dissemination of scientific knowledge through the active participation of students in the classroom. The assessment of the exercises given or solved in the board will have up to 10%. The deadlines and format of delivering exercises will be indicated by the lecturer. The minimum to average with the other contributions will be 4 out of 10.

• The laboratory evaluation will be 25% of the final grade. Attendance at laboratory classes is mandatory. The laboratory can be assessed with a specific test or/and reports which certify the knowledge acquired by students. The minimum to average with the other contributions will be 4 out of 10. The laboratory mark, if it is gretear than 5/10 points, will be valid for the academic year in which the student performs the laboratory sessions and the subsequent year.

• The subject is passed with a final score greater or equal to 5 points out of 10.

REFERENCES

Basic

- J.M. Kane, FISICA, Ed. Reverté.
- F. Cussó, C. López, R. Villar, FISICA DE LOS PROCESOS BIOLOGICOS, Ed. Ariel.

Additional

- M. Ortuño, FISICA PARA BIOLOGÍA, MEDICINA, VETERINARIA Y FARMACIA, Ed. Critica.
- D. Jou, J.E. Llebot, C. Pérez, FISICA PARA LAS CIENCIAS DE LA VIDA, Ed. McGraw Hill.
- A.H. Cromer, FISICA PARA LAS CIENCIAS DE LA VIDA, Ed. Reverté.