Universitat Autònoma de Barcelona

2022/2023

Physics

Code: 103250
ECTS Credits: 6

Degree	Type	Year	Semester
2501925 Food Science and Technology	FB	1	1

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

Lluc Sendra Molins
Rosa Flaquer Galmés
Daniel Campos Moreno

Prerequisites

The student should be familiar with basic Physics knowledge, especially the topics related to forces or energies. These topics are covered in the secondary school courses If the student has never studied them it would be good to do the propedéutic course of Physics for Biosciences. it is also recommended at least to read a secondary grade textbook including them.

Objectives and Contextualisation

The main objective of the course is to explain that Physics is a useful tool for the deep analysis of problems for Food Science and Technology. We will put the focus on the physical principles behind industrial processes for caracterizing and conserving food, and the different techniques for processing and cooking it.

It is not the idea then to study Physics at a fundamental level but to show how laws and concepts from physics, which are expressed through simple equations, can help to understand technological problems in the field. This should allow the student to reach an ability to analyse such problems from a quantitative point of view, and to identify the relevant parameters for each specific process and the mechanisms for measuring and analysing them.

Competences

- Adopt an ethical stance and attach importance to quality in work.
- Analyse, summarise, resolve problems and make professional decisions.
- Apply knowledge of the basic sciences to food science and technology.
- Apply the scientific method to resolving problems.

- Communicate effectively with both professional and non-professional audiences, orally and in writing, in the first language and/or in English.
- Develop individual learning strategies and planning and organisation skills.
- Display knowledge of the physical, chemical, biochemical and biological properties of raw materials and foods.
- Search for, manage and interpret information from different sources.
- Stay abreast of new knowledge, adapt to new situations and develop creativity.
- Take the initiative and display an entrepreneurial spirit.
- Use IT resources for communication, the search for information within the field of study, data processing and calculations.

Learning Outcomes

1. Adopt an ethical stance and attach importance to quality in work.
2. Analyse, summarise, resolve problems and make professional decisions.
3. Apply the scientific method to resolving problems.
4. Communicate effectively with both professional and non-professional audiences, orally and in writing, in the first language and/or in English.
5. Describe simply the principles of thermodynamics and apply them to a macroscopic system.
6. Describe the basic principles of mechanics and apply them to simple situations.
7. Develop individual learning strategies and planning and organisation skills.
8. Identify the basic properties of the important forces and electric currents.
9. Identify the dimensions of physical properties and correctly use the international system of units.
10. Identify the important parameters in transport phenomena.
11. Identify the properties of fluids that are important for describing complex materials of biological origin.
12. Search for, manage and interpret information from different sources.
13. Stay abreast of new knowledge, adapt to new situations and develop creativity
14. Take the initiative and display an entrepreneurial spirit.
15. Use IT resources for communication, the search for information within the field of study, data processing and calculations.

Content

1. Introduction: magnitudes and basic units of physics.
Main magnitudes and units in Physics. Relations between them Application: metabolic needs at rest and in motion.

2. Mechanical properties and mechanical treatments of food.
Sensory food profile; Mechanical properties: elasticity, plasticity, hardness.Textures and structures of food. Effects of the pressure on the materials: deformation, pressing, sterilization

3. Fluid properties of food and applications.
Physical laws of fluids. Hydrostatic Surface tension Emulsions Hydrodynamics. Newtonian viscous fluids. Law of Poiseuille. Power. Non-Newtonian Fluids and Rheology. Rheology of some foods. Osmotic pressure Reverse osmosis Potabilization of sea water.

4. Thermal properties and thermal treatments of foods.
Heat and temperature. Biological effects of temperature. Thermal treatment of foods (pasteurization HTST, UHT). Heat transport: conduction, convection, radiation. Transport of matter: diffusion, osmosis. Second principle of thermodynamics. Entropy Refrigerators and heat pumps. Phase changes Freezing, evaporation. Conservation of food. Culinary processes. Pressure cookers Sun and gels Denaturalization of proteins. Energy and food production; sustainability

5. Electrical properties of food.
Electricity and food technology. Forces and electrical potentials in molecular and cell biology. Electric current, Ohm law. Joule effect. Electric stoves and ovens. Magnetism Magnetic induction Alternating current Induction plates

6. Electromagnetic waves and food.
Radiation and food. Classical and quantum aspects of light: reflection, refraction, colorimetry, polarimetry. Interaction between microwave and food, microwave ovens. Effects of ionizing radiation on food. Sterilization of food

Methodology

Theory classes: We introduce basic concepts of physics to a level accessible to students who have not studied physics in the second grade of Batxillerat and we will illustrate, in each class, their biological applications. The material exposed to the classes will be available on the Virtual Campus of the subject. Small tests will be proposed periodically to help the students knowing their degree of understanding of the topic.

Problem sessions: Problems illustrate the biological application of the physical equations studied in theory. Part of the problems will be done in class by the problem teacher, so that students - who have done the problems at home - can know the degree of success of their solutions and correct them; Other problems must be resolved and delivered by the student directly to the teacher.

Other training activities: Consist in the development of a couple of brief works on some dissemination articles that illustrate the relevance of the interdisciplinarity between physics and biology.

Individual tutoring (eventually one in group may be organized) will resolve doubts and guidelines will be given for the preparation of the work.

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			
Problems sessions	15	0.6	2, 3, 7, 10, 9, 8
Self-learning	30	1.2	2, 3, 12, 7, 14, 15
Theory classes	38	1.52	5, 10, 9, 8
Type: Supervised			
Tutoring sessions	5	0.2	2, 12
Type: Autonomous			
Individual study	46	1.84	2, 3, 1, 12, 7

Assessment

1. Exams (80% of the overall mark)

There will be 2 partial exams, eliminatory. The weight of each exam will be 40%. To be able to pass the subject it will be necessary that the mark of each part is higher than 3.5. Students who have not passed the partial exams will have a final second exam, in which the partial or pending partial can be achieved.

2. Follow-up questionnaires (10% of the overall mark)

At the end of each topic of the course a list of short questions and exercises will be proposed for the student to check if she is following the course satisfactorily.

3. Moodle questionaries (10% of the overall score)

During the second half of the course some additional questionnaires (3/4) will be proposed through the Moodle room in order for the student to work some applied aspects of the course.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Follow-up questionnaires	10%	4	0.16	3, 12, 7, 9, 13
Moodle Questionnaires	10%	4	0.16	3, 12, 4, 7, 14, 15
Partial exam 1	40%	4	0.16	2, 1, 5, 6, 10, 9, 8, 11, 13
Partial exam 2	40%	4	0.16	5, 6, 10, 9, 8, 11

Bibliography

Introductory book: D Jou, J E LLebot i C Pérez-Garcia, Fisica para las ciencias de la vida, Ed Mc_Graw Hill, Madrid, 2009

Other introductory books:

J. W. Kane i M. M. Sternheim, Física, Reverté, Barcelona, 1989

M. Ortuño, Física para biología, medicina, veterinaria y farmacia, Crítica, Barcelona, 1996

Further reading:

L.O. Figura & A.A.Teixeira, Food Physics, Springer-Verlag Berlin Heidelberg 2007.

Software

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