Universitat Autònoma de Barcelona

2019/2020

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

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. Physical concepts like electromagnetic fields and waves, although important, are not required because they are introduced again during the course.

Objectives and Contextualisation

The main objective of the subject is to show that physics is a useful instrument for the in-depth comprehension of various problems related to Food Science and Technology. We are aware that the subject should not be an objective in itself, isolated from the technological context, but must be integrated the main objectives of the degree.

The educational objective of the subject is to give to the student knowledge related to basic principles of Physics that are useful for their professional future.

We expect that the concepts introduced will help the student in the skill of quantitative modelization of some specific phenomena. In particular, being able to identify the relevant parameters of the phenomena studied and the corresponding simple model and its approximate solution.

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. Optical properties of 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.

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.

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	55	2.2	2, 3, 1, 12, 7

Assessment

1. Exams (80% of the overall score)
There will be 2 partial exams, eliminatory. The weight of these exams will be 40% (the first) and 40% (the second). 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. Problems and works. (20% of the overall score)
The presentation of the work on dissemination articles and solved problems.

It will be considered that a student is not evaluable if he has participated in evaluation activities that represent $\leq$ 15% of the final grade

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
First and second-examination tests	0	3	0.12	2, 3, 5, 6, 10, 9, 8, 11
Parcial exams	8/10 (80 %)	4	0.16	2, 1, 5, 6, 10, 9, 8, 11, 13
Problems and works	2/10 (20 %)	0	0	3, 12, 4, 7, 14, 15

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.