

Physics

Code: 103250
ECTS Credits: 6

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

Contact

Name: Daniel Campos Moreno

Email: daniel.campos@uab.cat

Teaching groups languages

You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

Teachers

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 and/or studying some textbooks at the level of pre university courses.

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 characterizing 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 first-year students, putting most of the focus on biological, technological and industrial applications adapted to the degrees' profile. The theoretical part of the course will be partially based on a flipped-classroom methodology, with supporting materials (available through the Campus Virtual in PPT or video format) to be explored as an advance for the contents that will be developed in the classroom. These materials will have a multilevel format and will come together with some short tests that the student will take to check whether she possesses the previous concepts and knowledge that are necessary to follow the classroom sessions.

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.

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			

Assessment

1. First partial exam (35% of the global grade)

The first partial exam will have a weight of 35% over the final grade and will include the contents corresponding to themes 1-3 of the course. To pass the course it will be necessary to get a minimum grade of 3,5 in this activity. Those students that do not pass this activity will have the option of a retake examen that will follow the same functioning.

2. Second partial exam (45% of the global grade)

The second partial exam will have a weight of 45% over the final grade and will include the contents corresponding to themes 4-6 of the course. To pass the course it will be necessary to get a minimum grade of 3,5 in this activity. Those students that do not pass this activity will have the option of a retake examen that will follow the same functioning.

3. Follow-up tests (10 % of the global grade)

At the end of each theme a test based on short questions will be proposed as a tool for the students to check whether they have understood and integrated the concepts of the theme correctly. This activity will not have a retake option.

4. Moodle questionnaires (10% of the global grade)

During the second half of the course some (3/4) questionnaires will be proposed for the students to work out some applied concepts of the course. This activity will not have a retake option.

FUNCTIONING OF THE SINGLE-ASSESSMENT EVALUATION

The students who decide to follow the single-assessment evaluation will both take a single exam and will deliver the Moodle questionnaires on a fixed date (follow-up tests, which are explicitly thought as part of an on-going evaluation, will not be considered as an evaluation activity in this case). To pass the course the global grade must be 5 or higher.

1. General exam (90% of the final grade)

The general exam will have a weight of 90% over the final grade and will include the contents corresponding to all themes (1-6) of the course. Those students that do not pass this activity will have the option of a retake examen that will follow the same functioning.

2. Moodle questionnaires (10% of the global grade)

Some (3/4) questionnaires will be proposed for the students to work out some applied concepts of the course. This activity will not have a retake option.

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	35%	4	0.16	2, 1, 5, 6, 10, 9, 8, 11, 13
Partial exam 2	45%	4	0.16	5, 6, 10, 9, 8, 11

Bibliography

Preparation for the course

D Jou, J E LLebot i C Pérez-Garcia, Física para las ciencias de la vida. Mc_Graw Hill, 2009

Activities in the Jove platform (<https://www-jove-com.are.uab.cat/es/>)

Other basic books

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

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

M.J. Lewis. Physical Properties of Foods and Food Processing Systems. Woodhead Publishing Limited, 2006

Complementary readings

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

R.P. Singh and D.R. Heldman. Introduction to Food Engineering. Elsevier, 2009

D.-W. Sun. Emerging Technologies for Food Processing. Elsevier, 2014.

Software

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