COURSE DATA

Data Subject	
Code	33977
Name	Physics
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1103 - Degree in Food Science and Technology	Faculty of Pharmacy and Food Sciences	1	Second term

Subject-matter

Degree	Subject-matter	Character
1103 - Degree in Food Science and Technology	5 - Physics	Basic Training

Coordination

Name	Department
HERNANDEZ LUCAS, MARIA JESUS	345 - Earth Physics and Thermodynamics

SUMMARY

This course is intended for students to start on the concepts and physical phenomena of interest in issues related to food industry and research.

The course is divided into four parts: errors and units, fluid Mechanics, Thermodynamics and wave phenomena. Lectures and exercises are given in the classroom with the entire group. Experiments are performed in the laboratory into smaller groups of 16 students. Also 2 seminars and 2 tutorial classes are part of the course.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

It is strongly recommended that the student had taken Physics and Mathematics courses in Secondary School. Otherwise, the students will have to work harder to stand on an equal footing with the rest of the class.

OUTCOMES

1103 - Degree in Food Science and Technology

- Knowledge and understanding of the fundamentals of physics in theoretical and experimental aspects, and the mathematical background needed for its formulation.
- Know how to apply the acquired knowledge to the professional activity, solve problems and develop and defend arguments.
- Desarrollo de habilidades de aprendizaje necesarias para emprender estudios posteriores con un elevado grado de autonomía.
- Problem solving: be able to evaluate clearly the orders of magnitude in situations which are physically different, but show analogies, thus allowing the use of known solutions in new problems
- Theoretical understanding of physical phenomena: have a good understanding of the most important physical theories (logical and mathematical structure, experimental support, described physical phenomena).
- Be able to understand and master the use of the most commonly used mathematical and numerical methods.
- Modelling & Problem solving skills: be able to identify the essentials of a process / situation and to set up a working model of the same; be able to perform the required approximations so as to reduce a problem to an approachable one. Critical thinking to construct physical models
- Basic and applied research: acquire an understanding of the nature of research in physics, how it is conducted and how physics research is applicable to many different fields; be able to design experimental and/or theoretical procedures for: (i) solving common problems in academic or industrial research; (ii) improving existing results.
- Learning skills: be able to engage in new fields of science and technology in general through independent study.

LEARNING OUTCOMES

• Knowledge of the International System units and assigning them correctly to each physical magnitude. Determining dimensions and checking homogeneity in physical equations. Uncertainty assessment, error analysis and linear regression.

• Application of the principles of Mechanics to fluid systems. Understanding concepts of pressure and Archimedes' principle, distinguishing among movement regimens, using the continuity and Bernoulli's equations. Knowledge of the concept of viscosity and its effect on the Poiseuille's flow. Understanding the surface phenomena, the Laplace's equation importance and their applications.

• Understanding of temperature and heat concepts and conservation of energy in the First Principle of Thermodynamics. Understanding of the meaning of the Second Principe of Thermodynamics and its importance. Knowledge the more relevant thermal properties.

• Learning of the basic phenomena of waves. Understanding the mechanisms of hearing, and the acoustic wave applications.

• Solving numerical problems as an application of the theoretical concepts.

• Retrieval and interpretation of results from experimental data.

DESCRIPTION OF CONTENTS

1. MEASURES, MAGNITUDES AND UNCERTAINTIES

Laws and physical magnitudes. Dimensions. Units. Scalar and vector magnitudes. Fields. Uncertainties and significant figures. Absolute and relative error. Determination of errors in direct and indirect measurements. Data representation: tables and figures. Linear interpolation. Fittings. Regression equations.

2. IDEAL FLUIDS

Definition of fluid. Pressure concept. Classification of fluids. Types of regimes. Continuity equation. Pascals principle. Archimedes principle. Hydrostatic equation. Bernoullis equation. Venturis effect and Torricellis theorem.

3. VISCOUS FLUIDS

Friction forces. Viscosity. Newtons law. Newtonian fluid in laminar regime. Poiseuilles equation. Newtonian fluid in turbulent regime. Reynolds number. Sedimentation. Non-Newtonian fluids.

4. SURFACE PHENOMENTA

Surface tension. Surface tension force. Drops and bubbles: Laplace's equation. Tate's Law Contact angle. Applications to emulsions and foams. Jurin's law of capillarity.

5. THERMODYNAMIC SYSTEMS, TEMPERATURE AND HEAT.

Introduction. Thermodynamic systems. Thermodynamic Equilibrium. State variables. Zeroth Law of Thermodynamics: Temperature. Thermometric scales. Temperature measurement. Isotherm compression and isobaric expansion in liquids and solids. Ideal gas equation. Thermodynamic work. Heat. Heat capacity, specific and molar heat. Calorimetry. Latent heat. Heat transfer: conduction, convection and radiation. Newton's law of cooling. Applications.

6. FIRST AND SECOND LAWS OF THERMODYNAMICS

Internal energy. Joule's experiment. First Law of thermodynamics. Elemental processes for an ideal gas. Second Law of thermodynamics. Thermal machines

7. WAVES

Definition and types of waves. Mathematical description. Wave function. Mechanical wave energy. Power. Spherical waves and wave intensity. Attenuation. Absorption. Interference. Diffraction.

8. ACOUSTICS

Acoustic wave. Magnitudes. Transmission and reflection factors. Speed of propagation. Sound qualities: intensity, tone and timbre. Sound perception. Weber-Fechners law. Equal-loudness curves. Infrasound and ultrasound. Applications.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Laboratory practices	15,00	100
Seminars	2,00	100
Tutorials	2,00	100
Development of group work	10,00	0
Development of individual work	5,00	0
Study and independent work	20,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	25,00	0

Preparing lectures	5,00	0
Preparation of practical classes and problem	20,00	0
TOTAL	**147,00**	

TEACHING METHODOLOGY

• The classroom lectures will deal with the main concepts of the subject and their practical applications and the teacher will use material (slides, digital resources and interactive applications) that will be shared to students. The participation of the students will be encouraged.

• The students can access to a collection of problems for each unit. The professor will solve some of these problems in class, and some others will be assigned as homework.

• The tutorial lectures will consist on groups of 16 students discussing interesting exercises with the professor. The work of the students during such sessions will be part of the marks.

• In the seminar sessions (in groups of 40 students), oral presentation (with slides) will be done by the students (in subgroups) on the topics proposed in the different subjects (the seminars are coordinated among all the subjects of the semester, so that only one topic should be done for each subgroup). The seminar deliverables are: a written report (minimum 10 pages, 5000-8000 words), a work diary and an oral presentation about a topic suggested by the professor. The presentation will be divided into different parts, so that each student in the subgroup will present 5-7 minutes. The students will work in groups of 3-5 and the results will be part of the marks. The attendance of 100% of the seminaries is compulsory. An unjustified absence will be reflected as a mark equal to zero.

• The laboratory consists of 8 experiments divided in 4 sessions, with 16 students and one professor. The students will work in pairs and will have to hand in a written report detailing the experimental data, analysis (errors, graphs, fittings), and conclusions. The use of spreadsheet applications will be encouraged, particularly during the laboratory session. Attendance to laboratory session is compulsory and required to pass the subject.

During the lectures, examples of the applications of the contents of the subject in relation to the Sustainable Development Goals (SDG) will be indicated, in addition to being included in the proposals of topics for the coordinated seminars. The purpose is to provide students with knowledge, skills and motivation to understand and address these SDGs.

EVALUATION

The evaluation of the subject is divided into two blocks (in parentheses the weight of each part in the total)

Theoretical part

- written exam with theoretical questions and problems (65%)
- tutorials and classroom work (delivery of exercises and tasks) (5%)
- coordinated seminars (10%)

Laboratory part

- written exam (10%)
- laboratory reports (10%)

The attendance of 100% of the laboratory is compulsory. Absence must be justified and will require the student to make up the corresponding session with another group.

To pass the subject, it is necessary to obtain a grade of 4/10 (4 out of 10) both in the theory exam (which represents 65% of the evaluation), which means 2.6 points out of 6.5, as in the laboratory (which is 20% of the evaluation), which means 0.8 points out of 2.0.

If a student does not take the exam in both calls, the mark will be "Not present". If a student passes the laboratory part, the mark will be valid and kept for two academic years. After that, the student will have to repeat the laboratory part.

REFERENCES

Basic

- Herráez, J. V. y Delegido, J., 2010. Elementos de Física Aplicada y Biofísica, PUV, Universitat Valencia.
- Davidovits P., 2008, Physics in Biology and Medicine, Academic Press.
- Jou D., 2008, Física para las ciencias de la vida, McGraw-Hill.

Additional

- Figura L.O. y Teixeira A.A.,2007, Food Physics, Springer
- Frumento, A., 1995. Biofísica, Mosby: Doyma Libros.