

**COURSE DATA****Data Subject**

<b>Code</b>	34108
<b>Name</b>	Physics
<b>Cycle</b>	Grade
<b>ECTS Credits</b>	6.0
<b>Academic year</b>	2022 - 2023

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. year</b>	<b>Period</b>
1201 - Degree in Pharmacy	Faculty of Pharmacy and Food Sciences	1	First term
1211 - Double Degree in Pharmacy and Human Nutrition and Dietetics	Faculty of Pharmacy and Food Sciences	1	First term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
1201 - Degree in Pharmacy	8 - Physics	Basic Training
1211 - Double Degree in Pharmacy and Human Nutrition and Dietetics	1 - Asignaturas obligatorias del PDG Farmacia-Nutrici3n Humana y Diet3tica	Obligatory

**Coordination**

<b>Name</b>	<b>Department</b>
JIMENEZ MUÑOZ, JUAN CARLOS	345 - Earth Physics and Thermodynamics

**SUMMARY**

Physics is a first-year 6-credits quarterly core subject taught in the first quarter of the academic year.

The objective is to initiate the student in physical concepts and phenomena of interest in industry and in pharmaceutical research.

The subject may be considered as divided up in four basic blocks to study: measurements, errors and uncertainties, and unit systems, ideal and real fluid mechanics, thermodynamics, wave phenomena, and ionizing radiation.



There is a part of theory and problems that is taught in the classroom for the full group and another part composed of laboratory practicals that is taught in the laboratory in 16-students subgroups. It also helps to complete the student's training with 2 seminars and 2 tutorials in small groups.

## 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 recommended that students have previously studied the subjects of Mathematics II and Physics in 2nd year Bachillerato (Sixth Form Senior High School). The prerequisites are: operation with logarithms and fractions; derivative and integration of elementary functions; basic trigonometry: sine, cosine, tangent; solution of equations of first and second degree; exponential equations

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

### 1201 - Degree in Pharmacy

- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Develop know-hows for their professional career.
- Identify, analyse and solve new problems; build and defend arguments
- Learning capabilities: be able to gain knowledge in different domains of Science and Technology through independent work
- Know how to apply the scientific method and acquire skills for managing the main bibliographic sources.
- Understand the experimental and theoretical basis of Physics and its mathematical requirements
- Problem solving: evaluation of orders of magnitude; identify situations with similar physics involved to use analogy in the solutions
- Understanding of the theories behind physical phenomena: knowledge of the more relevant physical models (mathematical and logical structure, experiments and physical description)
- Mathematical skills: be competent in the mathematical and numerical methods more common.
- Modelling and problem solving: identify the key elements in a process/situation to be able to model it; simplify the problem to a manageable size; use of critical thinking to make physical models.
- Basic and applied research: understand the research in Physics and its applications; design of experimental/theoretical procedures to: (i) solve current problems in academic and industrial research; (ii) improve the existing solutions.

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

- To know the SI units and assign them correctly to each physical quantity. To determine the dimensions of the physical quantities and be able to recognize the homogeneity of Physics formulae. To use error analysis and linear regression.
- To apply the principles of Mechanics to fluid systems. To understand the concept of pressure and Pascal's Principle, to distinguish the types of flow, to properly apply the Continuity and the Bernoulli's equations, to know the concept of viscosity and its effect on Poiseuille flow. To understand surface phenomena and their influence on the action and formulation of a medicament.
- To understand the concept of temperature, apply the ideal gas state equation, understand heat as a process of energy exchange and the generalization of energy conservation in the First Principle of Thermodynamics. To calculate energy exchanges in simple processes and ideal gas cycles. To understand the meaning of the Second Principle of Thermodynamics. To understand the concept of entropy and its calculation on simple ideal gas processes. To distinguish between reversible and irreversible processes. To apply the concept of entropy to living beings.
- To know and understand basic waves phenomena in order to understand the mechanisms of hearing and vision.
- To know the basics and main applications of ultrasounds and infrasounds
- To distinguish between ionizing and non-ionizing radiation and understand the basics of physical and biological dosimetry.
- To introduce data acquisition protocols in the laboratory: errors, differences between accuracy and precision.
- Establishing equations that describe observed phenomena: least squares fitting.
- To solve numerical problems as a consequence of the application of abstract reasoning and the equations that describe the phenomena studied.
- To obtain and interpret reliable parameters from experimental data.

**DESCRIPTION OF CONTENTS****1. PHYSICAL QUANTITIES AND MEASUREMENTS**

Physical magnitudes. Units

Uncertainties. Types and expression of uncertainties

Estimation of uncertainties in direct measurements

Propagation of uncertainty: equations, tables (linear interpolation) and graphics

Data plotting: tables and figures

Interpolation

Modeling. Linear fit. Model validation



## 2. IDEAL FLUIDS

Fluid: definition and types  
Concept of Pressure. Pascal's Principle  
Types of flows  
Continuity Equation  
Bernoulli's Principle  
Hydrostatic Equation  
Archimedes' Principle  
Applications: Venturi effect, Torricelli's law  
Measurements of pressure

## 3. REAL FLUIDS

Viscosity. Navier's Hypothesis. Dependence with temperature and pressure  
Poiseuille's equation  
Turbulence and Reynolds number  
Motion of a solid in a fluid. Sedimentation velocity  
Newtonian and non-Newtonian fluids. Classification and rheology models.  
Aplicaciones

## 4. SURFACE PHENOMENA

Surface tension  
Contact angle  
Curved surfaces (drops, bubbles, alveoli...): Laplace Equation  
Capillarity: Jurin Equation  
Liquid drop formation: Tate Equation  
Surfactants and humectants  
Applications

## 5. TEMPERATURE AND FIRST LAW OF THERMODYNAMICS

Basic concepts  
Temperature. Zeroth Law of Thermodynamics  
Thermometric variables and scales. Thermometers  
Thermal equations and coefficients  
Energy conservation and transformation law  
Concepts of heat as a type of energy and work. Internal energy.  
First law of Thermodynamics



## 6. HEAT, WORK AND INTERNAL ENERGY

Work

Clapeyron diagram and work calculation

Heat: thermal capacity and specific heat

Heat of transformation and latent heat

Internal Energy

Calorimetric techniques

Newton's law of cooling

Heat propagation

Internal energy and Joule's experiment

Enthalpy

Application to the ideal gas

Thermodynamics applied to living beings

## 7. THE SECOND PRINCIPLE OF THERMODYNAMICS

The second principle of Thermodynamics

Carnot and Kelvin-Planck statements

Carnot's cycle

Entropy

Entropy Variation Calculations

Entropy Diagrams

Application to the ideal gas

## 8. WAVES AND OPTICS

Definition and types. Propagation equation

Energy, power and intensity

Attenuation, absorption and transmission

Refraction and reflexion. Refraction index. Snell's law. Limit angle

Polarization. Interference. Diffraction

Vision optics: lens, human eye, refractive errors and corrections

## 9. ACOUSTICS

Sound waves. Quality of sound: intensity, pitch, timbre

Sound physical quantities

Reflection and refraction of sound

Speed of propagation of sound

Human hearing

Sound perception: Weber-Fechner law

Sound sensibility: experiment of Fletcher and Mundson

Ultrasounds: production, properties and medical and pharmacological applications



**10. IONIZING RADIATION**

Classification of electromagnetic waves  
X Rays: generation and biological effects. Applications  
Radioactivity: types, half-life period, activity  
Dosimetry  
Ionizing radiation: biological effects  
Radiopharmaceuticals

**11. LABORATORY SESSIONS**

Measurement of density of solids  
Measurement of density of liquids

Measurement of viscosity : Newtonian fluids  
Measurement of viscosity : Non-Newtonian fluids

Measurement of surface tension: pendant drop test  
Newtons cooling law

Sound measurements  
Measurement of refractive index

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Laboratory practices	15,00	100
Seminars	2,00	100
Tutorials	2,00	100
Attendance at events and external activities	2,00	0
Development of group work	8,00	0
Development of individual work	8,00	0
Study and independent work	20,00	0
Readings supplementary material	2,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	8,00	0
Preparation of practical classes and problem	20,00	0
Resolution of case studies	2,00	0
<b>TOTAL</b>	<b>147,00</b>	



## TEACHING METHODOLOGY

The subject has two parts with a distinct methodology: blackboard classes (theory and problems) and laboratory sessions.

The development of classes is as follows:

- In the lectures the professor gives the theoretical contents. The professor may provide different materials (slides, teaching notes, graphs and diagrams...), as well as bibliographic references. For each unit a set of problems will be provided. The professor will solve some of them on the blackboard and the rest will be suggested as homework.
- The seminars and tutorials may consist on answering questions, solving class exercises. In addition there might be presentations or conferences intended to be catalyist for studens.
- 8 laboratory practicals will be carried out by the students, distributed in 4 sessions. These are given to students in 16-student subgroups with an assigned professor. For each practical, the student pair will hand in a report containing the experimental data and its treatment (errors, graphs, fittings), as well as the analysis of results and conclusions drawn. Emphasis will be given to the use of software for data processing (spreadsheets) during the laboratory practicals with the computers that are made available in the laboratory itself.

## EVALUATION

Subject marking is divided in two blocks:

- Theory (80% of the mark)
  - written exam with theoretical questions and problems (70%)
  - seminars, tutorials and classroom work (10%)
- Laboratory (20% of the mark)
  - 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 attend the session with another group.

It is necessary to get at least 4/10 mark in each item to pass Physics. If a student does not take the exam in both calls, the grade will be "*Not present*". If a student passes the laboratory part, the mark will be valid for two academic years. After that, the student will have to repeat the laboratory part.



## REFERENCES

### Basic

- Herráez J.V. y Delegido J. (2015), Elementos de Física Aplicada, Universitat de València.
- Davidovits P. (2008), Physics in Biology and Medicine, Academic Press.
- Catalá J. (1988), Física, Fundación García Muñoz.
- Jou D. (2008), Física para las ciencias de la vida, McGraw-Hill.

### Additional

- Cromer A.H. (1986), Física para las ciencias de la vida, Reverté
- Frumento A. S. (1995), Biofísica, Doyma Libros.
- Irving P. (2007), Physics of the human body, Springer.