COURSE DATA

Data Subject	
Code	34108
Name	Physics
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1201 - Degree in Pharmacy	Faculty of Pharmacy	1	First term
1211 - D.D. in Pharmacy-Human Nutrition and Dietetics	Faculty of Pharmacy	1	First term

Subject-matter

Degree	Subject-matter	Character
1201 - Degree in Pharmacy	8 - Physics	Basic Training
1211 - D.D. in Pharmacy-Human Nutrition and Dietetics	1 - Asignaturas obligatorias del PDG Farmacia-Nutrición Humana y Dietética	Obligatory

Coordination

Name	Department
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

OUTCOMES

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

- 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
Bernoullis Principle
Hydrostatic Equation
Arquimedes' Principle
Applications: Venturi effect, Torricelli's law
Measurements of pressure

3. REAL FLUIDS

Viscosity. Navier's Hypothesis. Dependence with temperature and pressure
Poiseuilles 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
Capilarity: 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
Aplication 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
Aplication 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
TOTAL	**147,00**	

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 cathalyst 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.