VNIVERSITAT DE VALÈNCIA

Course Guide
34108 Physics

COURSE DATA

Data Subject	
Code	34108
Name	Physics
Cycle	Grade
ECTS Credits	6.0
Academic year	2024 - 2025

Study (s)

Degree	Center	Acad. year	Period
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

Degree	Subject-matter	Character
1201 - Degree in Pharmacy	8 - Physics	Basic Training
1211 - Double Degree in Pharmacy and 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 Basic Training subject (Obligatory subject in the case of the DD) taught in the first quarter of the academic year.

The objective of this subject is to provide main physical concepts and to describe physical 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.

The School of Pharmacy and Food Science is a pilot center of the Universitat de València for the implementation of the Sustainable Development Goals (SDG). From the Physics subject, we propose to perform activities that allow a reflection about the role of Physics to achieve the SDGs.

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 International System of Units (SI) 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, the fundamental equation of Hydrostatics, Arquimedes' Principle, to know the concept of viscosity and Navier's hypothesis, its effect on Poiseuille flow, pressure drop, Reynolds Number, sedimentation. To understand surface phenomena and Laplace, Jurin and Tate's laws, and their influence on the action and formulation of a medicament.

• To understand the concept of temperature and its measure. The First Principle of Thermodynamics and energy conservation, to understand heat as a process of energy exchange, as well as thermodynamic work and the generalization to any system. 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 energy and entropy to living beings.

• To know and understand basic waves phenomena and its application to vision optics and sound. The Doppler's effect and its applications. To know the basics and main applications of ultrasounds. To understand the mechanisms of hearing and vision, and the correction of refractive errors.

• To distinguish between ionizing and non-ionizing radiation, to know the different types of radioactivity and biological effects of ionizing radiation, to understand the basics of physical and biological dosimetry, and radiopharmaceuticals.

• 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. MAGNITUDES AND MEASUREMENTS

Physical magnitudes and units. Estimation of uncertainties. Results presentation. Interpolation. Least squares regression.

2. IDEAL FLUIDS

Definition of fluid. Concept of pressure. Pascal's Principle. Types of flows. Continuity Equation. Bernoulli's Principle. Fundamental equation of hydrostatics. Venturi's effect. Torricelli's law. Arquimedes' Principle. Measurements of pressure and its applications.

3. REAL FLUIDS

Definition of viscosity. Navier's hypothesis. Hagen-Poiseuille equation. Reynolds number. Sedimentation velocity. Newtonian and non-Newtonian fluids. Rheology models. Measurements of viscosity and applications.

4. SURFACE PHENOMENA

Surface tension. Contact angle. Laplace Equation. Jurin's law. Tate Equation. Measurements of surface tension. Surfactants and applications.

5. INTRODUCTION TO THERMODYNAMICS

Basic definitions. Concept of temperature and Zeroth Law of Thermodynamics. Thermometric scales. Measurements of temperature. Energy transfer as heat. Specific and latent heat. Calorimetric techniques. Heat propagation. Law of cooling. Applications of calorimetry and phase changes.

6. FIRST LAW OF THERMODYNAMICS

Thermodynamic work. Internal energy and Joule's experiment. First Law of Thermodynamics. Thermodynamics processes and Clapeyron diagram. Work, heat and internal energy variations calculations for an ideal gas. Graphical methods. Concept of enthalpy.

7. SECOND LAW OF THERMODYNAMICS

Justification of the second law. Thermal machines and Carnot's cycle. Statements of the Second Law of Thermodynamics. Definition of entropy. Reversible and irreversible processes. Entropy variations calculation for an ideal gas. Entropic diagrams. Thermodynamics applied to living beings.

8. WAVE MOTION

Basic concepts. Propagation equation. Energy, power and intensity. Attenuation, absorption and transmission. Doppler effect. Reflexion and refraction. Limit angle. Measure of the refraction index. Polarization. Interferences and diffraction.

9. ACOUSTICS AND OPTICS

Sound waves. Human hearing. Weber-Fechner law. Experiment of Fletcher and Mundson. Applications of ultrasounds. Vision optics. The human eye as a lens. Vision errors. Correction of refractive errors.

10. IONIZING RADIATION

X-rays and ionizing radiation. Basic concepts of atomic and nuclear physics: radioactivity. Physical and biological dosimetry. Radiopharmaceuticals.

11. LABORATORY SESSIONS

Measurement of density: solids
Measurement of density: solutions.
Measurement of viscosity: low viscosity fluids.
Measurement of viscosity: high viscosity fluids.
Measurement of surface tension.
Measurement of the cooling constant.
Measurements of sound intensity level.
Measurement of refraction index of solutions.

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
Study and independent work	20,00	0
Preparation of evaluation activities	30,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	20,00	0
TOTAL	**147,00**	

TEACHING METHODOLOGY

The subject has four types of activities with a well-differentiated methodology: theory and problem classes, tutorials, seminars and practical laboratory classes.

• **Theory and problem classes:** in these classes the professor teaches the basics of the subject using the blackboard and the visual resources of the classroom. Students must acquire the basic knowledge of the syllabus through individual study and class attendance. The professor will provide different resources and bibliographic material through the virtual classroom to facilitate individual study and class preparation by students. There will also be a bulletin of problems and questions to be solved by the professor in class and by the students individually.

• **Tutorial classes:** doubts that have arisen in the theory and problem classes will be resolved. Different activities will be proposed (problem solving, questionnaires, group work, etc.) that will allow students to better assimilate the concepts seen in the theory and problem classes, the qualification of which will form part of the continuous assessment.

• **Seminar classes:** these will be devoted to the deepening of some specific aspects of the subject and/or to show students the applications of the subject in the world of work. Activities will be proposed whose qualification will form part of the continuous assessment.

Attendance to tutorials and seminars is compulsory. The continuous assessment activities carried out in these classes are not recoverable.

• **Laboratory classes:** 8 laboratory practicals will be carried out in 4 sessions. These are taught by the professor in small subgroups (maximum of 16 students distributed in pairs). For each practical, the pair has to present a report of results. The format of the report will be proposed by the professor of each subgroup, and must include the experimental data taken during the practical, the results with the corresponding calculation of errors and an analysis of these results, and the main conclusions of the practical. The computers available in the laboratory may be used for making graphs and least squares regression, as well as any other data processing.

EVALUATION

The final assessment of the subject in the first call consists of 10% continuous assessment, 20% laboratory practices and 70% of the theory exam.

Continuous assessment (10%): activities carried out throughout the course that may consist of questionnaires, problem solving, attendance at tutorials and seminars, etc.

Theory exam (70%): written theory exam that will consist of numerical questions and problems or conceptual or reasoning questions.

Laboratory (20%): completion of laboratory practices, of which 60% of the mark will correspond to the completion of reports with the results of the practices and the corresponding error calculation, and the remaining 40% will correspond to the completion of a short written test on basic concepts of the practices and error calculation. Attendance at laboratory sessions is mandatory, except for justified reasons. In this case, the practice must be made up in another laboratory group after notifying the corresponding teaching staff.

To pass the course, students must obtain the following minimum marks: 4 in the theory exam, 5 in the written laboratory test, 5 in the overall laboratory mark, and 5 in the overall mark for the course (marks out of 10).

In the second call, the same criteria as in the first call will be applied.

If the student does not pass the course in the two calls of the course, the mark corresponding to the continuous assessment will not be maintained for subsequent courses. The overall laboratory mark will be maintained for three academic years if passed.

Evidence of copying or plagiarism in any of the assessable tasks will result in failure to pass the subject and in appropriate disciplinary action being taken. Please note that, in accordance with article 13. d) of the Statute of the University Student (RD 1791/2010, of 30 December), it is the duty of students to refrain from using or participating in dishonest means in assessment tests, assignments or university official documents. In the event of fraudulent practices, the “Action Protocol for fraudulent practices at the University of Valencia” will be applied (ACGUV 123/2020): https://www.uv.es/sgeneral/Protocols/C83.pdf.

REFERENCES

Basic

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- Davidovits P. (2018). Physics in Biology and Medicine, 5th edition, Academic Press.
- Jou i Mirabent, D., Pérez García, C., Llebot, J. E. (2009). Física para ciencias de la vida (2nd ed.). Madrid: 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.
- Tipler, P. A., Mosca, G. (2010). Física para la ciencia y la tecnología. Barcelona: Reverté.