Syllabus
2023 - 2024

GENERAL INFORMATION

Data of the subject	
Subject name	Physics
Subject code	DIM-IMAT-103
Mainprogram	Grado en Ingeniería Matemática e Inteligencia Artificial
Involved programs	Grado en Ingeniería Matemática e Inteligencia Artificial [First year]
Credits	9,0 ECTS
Type	Básico
Department	Department of Mechanical Engineering
Coordinator	Ana Megía Macías
Schedule	Please get an appointment by email

Teacher Information	
Teacher	
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DESCRIPTION OF THE SUBJECT

Contextualization of the subject

Prerequisites

Elemental calculus and basic knowledge of vector calculus

Course contents

Contents

Topic 1. Mechanics

1.1 Laws of motion

1.2 Circular motion and other applications of Newton's laws.
1.3 Energy of a system
1.4 Conservation of energy
1.5 Conservation of linear momentum and collisions.
1.6 Non-inertial reference frames

Topic 2. Transport in physical systems (fluids and heat)
2.1 Definition of fluid and hypothesis of the continuum
2.2 Newtonian and non-Newtonian fluids
2.3 Density and viscosity
2.4 Hydrostatics and hydrodynamics
2.5 Continuity equation and Bernoulli equation
2.6 Mechanisms of heat transfer: convection, conduction and radiation
2.7 First law of thermodynamics
2.8 Second law of thermodynamics

Topic 3. Electric field and potential
3.1 Electric charge and Coulomb's law
3.2 Electric field and electric potential. Gauss's law. Charge distributions
3.3 Conductors and dielectrics
3.4 Electric current, conductivity and current density

Topic 4. Magnetic field
4.1 Magnetic Force. Definition of magnetic field
4.2 Magnetic Force on Current-carrying conductors
4.3 Ampere's Law. Biot–Savart law
4.4 Time-varying fields
4.5 Induced current. Faraday's Law
4.6 Displacement current
4.7 Electromagnetism. Maxwell's equations

Topic 5. Electrical circuits
5.1 Elements of electrical circuits (resistors, capacitors and inductances)
5.2 Ohm's Law. Simple stationary circuits
5.3 Kirchhoff's Laws. Mesh method
5.4 Non-stationary circuits. Charge and discharge of a capacitor

Topic 6. Waves
6.1 Mechanical waves. Transverse, longitudinal and sound waves
6.2 Refraction, interference and diffraction of waves
6.3 Light as an electromagnetic wave
6.4 Interference and diffraction of light

Topic 7. Fundamentals of quantum physics

7.1 Experimental Basis of Quantum Physics

7.2 The Bohr atom

7.3 Electron diffraction

7.4 De Broglie waves. Wave-particle duality of matter and light

Topic 8. Quantum mechanics

8.1 Introduction to wave mechanics. Schrödinger equation

8.2 Wave functions

8.3 Wave packets

8.4 Probability amplitudes

8.5 Steady States

8.6 Heisenberg uncertainty principle

EVALUATION AND CRITERIA

Evaluation activities	Evaluation criteria	Weight
Individual and/or group activities	Understanding of concepts Application of concepts to the resolution of practical problems Analysis and interpretation of the results obtained in problem solving	15
Mid-semester exams Mid-term exam Final exam	Understanding of concepts Application of concepts to the resolution of practical problems Analysis and interpretation of the results obtained in problem solving	85

Grading

Ordinary evaluation

The subject is divided into two thematic blocks, corresponding to the contents taught in each semester. All the grades that follow are evaluated between 0 and 10 points.

First semester: The grade for the first semester (grade_C1) will be calculated as 85% of the grade of the exams taken during the first semester plus 15 % of the average of the grade obtained in the individual and/or group activities (grade_A1). The grade of the exams taken during the first semester is determined as 20% of the grade obtained from
the mid-semester exam of the first semester (grade_I1) plus 80% of the grade of the mid-term exam (grade_P1). Therefore: grade_C1=

0.85*(0.2*grade_I1+0.8*grade_P1)+0.15*(grade_A1).

The final exam will consist of two parts, one related to the first semester (grade_F1) and another one related to the second semester (grade_F2). Those students who obtained a grade equal to or higher than 4 in the first semester may choose to be evaluated only of the contents of the second semester in the final exam. However, those students who obtained a grade lower than 4 in the first semester must be evaluated of the contents of both parts. For these latter students, the new grade of the first semester will be determined as 85% of the grade of the final exam corresponding to the first semester (grade_F1) plus 15% of the average of the grade obtained in the individual and/or group activities of the first semester (grade_A1). Therefore: new_grade_C1=0.85*(grade_F1)+0.15*(grade_A1). For all students, the grade of the second semester will be calculated as 85% of the grade of the exams taken during the second semester plus 15 % of the average of the grade obtained in the individual and/or group activities (grade_A2). The grade of the exams taken during the second semester is determined as 20% of the grade obtained in the mid-semester exam of the second semester (grade_I2) plus 80% of the grade of the final exam corresponding to the second semester (grade_F2). Therefore: grade_C2= 0.85*(0.2*grade_I2+0.8*grade_F2)+0.15*(grade_A2).

For those students who obtained a grade equal to or higher than 4 in both semesters, the final grade of the subject (grade_final) will be determined as the average of the grades obtained in each semester. Then: grade_final=0.5*grade_C1+0.5*grade_C2.

For those students who obtained a grade lower than 4 in any of the semesters, the final grade of the subject will be calculated as the minimum grade between both semesters. Therefore: if grade_C1 < 4 or if grade_C2 < 4, then grade_final=MIN (grade_C1 ; grade_C2).

Extraordinary evaluation

Students who did not pass the ordinary evaluation will have a new opportunity in the extraordinary exam (June). This exam will have the same characteristics as the final exam. Those students who obtained in the ordinary call a grade equal or higher than 6 in any of the two semesters, will have the option to keep that grade and be evaluated in the extraordinary call only for the semester that they failed.

The grade of the individual and/or group activities will be kept for the calculation of the final grade of the extraordinary call.

Asistance

The absence to 15% or more of the classes of this subject may result in the impossibility to take to ordinary and extraordinary calls.

WORK PLAN AND SCHEDULE

Activities	Date of realization	Delivery date
Reading and study of the theoretical contents in the textbook and the personal workbook	After each lesson	
Solving of provided exercise collections	During the study of each topic	
Individual and group activities	Along the course	
Exams	October, December March, May and June	

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BIBLIOGRAPHY AND RESOURCES

Basic References

Paul A Tipler and Gene Mosca. Physics for Scientists and Engineers(6th edition). Vol. 1 & 2. W. H. Freeman (2014)

William Moebs, Samuel J. Ling y Jeff Sanny. University Physics. Vol. 1, 2 & 3. Openstax. Available online: https://openstax.org/details/books/university-physics-volume-1