Universidad de Navarra

Physics I

Teaching guide 2026-27

PRESENTATION

Brief description:

Qualification (Module/Subject):

- Industrial Technologies Engineering (Basic Training/Physics and General Chemistry)
- Mechanical Engineering (Basic Training/Physics and General Chemistry)
- Electrical Engineering (Basic Training/Physics and General Chemistry)
- Industrial Electronics Engineering (Basic Training/Physics and General Chemistry)
- Telecommunication Systems Engineering (Basic Training/Physics and General Electronics)
- Industrial Organisation Engineering (Basic Training/Physics and General Chemistry)
- Industrial Design and Product Development Engineering (Basic Training/Physics and General Chemistry)
- Biomedical Engineering (Basic Training/General Physics and Chemistry)
- Artificial Intelligence Engineering (Basic Training/General Physics and Electronics)

Details:

- **ECTS**: 8 ECTS
- **Year, semester**: 1st year, 1st semester
- **Character**: Basic
- **Language**: English

Lecturers in the subject:

- Sancho Erkizia, Ana / Profesora Titular
- Valderas Gázquez, Daniel / Profesor Titular
- Dorronsoro Larbide, Aritz / Profesor Colaborador
- Zapirain Sesma, Xabier / Profesor Ayudante

LEARNING OUTCOMES

ENGINEERING IN INDUSTRIAL TECHNOLOGIES

R1 - That the students have demonstrated to possess and understand knowledge in an area of study that starts from the basis of general secondary education, and is usually at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

R3 - Understanding and mastery of the basic concepts of the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to the resolution of engineering problems.

MECHANICAL ENGINEERING

R1 - That the students have demonstrated to possess and understand knowledge in an area of study that starts from the basis of general secondary education, and is usually found at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

R24 - Knowledge in basic and technological subjects, which enables them to learn new methods and theories, and gives them the versatility to adapt to new situations.

R4 - Understanding and mastery of the basic concepts of the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to the resolution of engineering problems.

ELECTRICAL ENGINEERING

R1 - That the students have demonstrated to possess and understand knowledge in an area of study that starts from the base of general secondary education, and is usually at a level that, although it is supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

R22 - Knowledge in basic and technological subjects, which enables them to learn new methods and theories, and gives them the versatility to adapt to new situations.

R3 - Understanding and mastery of the basic concepts of the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to the resolution of engineering problems.

INDUSTRIAL ELECTRONICS ENGINEERING

R1 - That the students have demonstrated to possess and understand knowledge in an area of study that starts from the basis of general secondary education, and is usually at a level that, although it is supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

R22 - Knowledge in basic and technological subjects, which enables them to learn new methods and theories, and gives them the versatility to adapt to new situations.

R3 - Understanding and mastery of the basic concepts of the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to the resolution of engineering problems.

TELECOMMUNICATION SYSTEMS ENGINEERING

R1 - That students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study. (Type: Knowledge or contents)

R4 - Understanding and mastery of the basic concepts of the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to solve engineering problems (Type: Knowledge or contents).

R5 - Understanding and mastery of the basic concepts of linear systems and related functions and transforms, theory of electrical circuits, electronic circuits, physical principle of semiconductors and logic families, electronic and photonic devices, materials technology and their application to solve engineering problems. (Type: Knowledge or contents).

INDUSTRIAL ORGANIZATION ENGINEERING

R1 - That students have demonstrated to possess and understand knowledge in an area of study that starts from the base of general secondary education, and is usually at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study;

R3 -Comprehension and mastery of the basic concepts on the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to the resolution of engineering problems.

R40 - Provide a solid foundation in science, technology, operations management, production and business management.

INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING

R1 - That students have demonstrated possession and understanding of knowledge in an area of study that starts from the basis of general secondary education, and is usually found at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

R4 - Understanding and mastery of the basic concepts of the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to the resolution of engineering problems.

BIOMEDICAL ENGINEERING

R1 - That the students have demonstrated to possess and understand knowledge in an area of study that starts from the basis of general secondary education, and is usually at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

R31 - The training must provide the graduate with a solid scientific base that allows him/her to rigorously address the professional challenges of the biomedical sector.

R21 - Understanding and mastery of the basic concepts of the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to the resolution of engineering problems.

ENGINEERING IN ARTIFICIAL INTELLIGENCE

R2 - Identify the basic electronic components and devices, as well as their use in the analysis and design of electronic circuits (Type: Knowledge or contents).

PROGRAM

1. ELECTROSTATICS

1.1 Electric charges

1.2 Electrical Behavior of Materials

1.3 Coulomb's Law

1.4 Electric field

1.5 Electric field flow: Gauss's Theorem

1.6 Electric field flow: electric potential and electric potential energy

1.7 The capacitor

2. ELECTRODYNAMICS

2.1 Introduction

2.2 Electric Current and Electric Power

2.3 Basic Electrical Components

2.4 Fundamental Laws for the Calculation of Magnitudes in Electric Circuits

2.5 The diode

3. OSCILLATIONS, ENERGY AND WAVES

3.1 Introduction to wave phenomena

3.2 The wave formula

3.3 Pulse propagation

3.4 Sinusoidal wave propagation

3.5 Case studies

3.6 Wave interference or superposition

3.7 Wave Energy

3.8 Waves in 1D, 2D and 3D

4. MAGNETISM

4.1 Introduction

4.2 Force exerted by a magnetic field

4.3 Motion of a point charge in a magnetic field 4.4 Magnetic field created by moving point charges

4.4 Magnetic field created by point charges in motion

4.5 Law of Biot and Savart

4.6 Magnetic force between parallel conductors

4.7 Gauss's law of magnetism

4.8 Ampère's law

4.9 Magnetic induction

5. MAXWELL'S EQUATIONS AND ELECTROMAGNETISM

5.1 Electromagnetic waves and the Doppler effect

5.2 Maxwell's equations

5.3 Emission and propagation of electromagnetic waves

5.4 Antennas

5.5 Propagation of electromagnetic waves through dielectric and conductive media

5.6 Electromagnetic waves propagation through dielectric and conductive media

EDUCATIONAL ACTIVITIES

The **dedication of 200-240 hours (8 ECTS)** to the Physics course is divided into the following training activities:

- Theoretical presential classes: 80 hours
- Practical presential classes, laboratories or workshops: 3 hours
- Tutoring: 20 hours
- Personal study: 100 hours
- Evaluated tests: 8 hours

TEACHING METHODS

- Lecture classes
- Laboratory classes
- Individual work, problem solving and laboratory reports.
- Evaluated tests

ASSESSMENT

Evaluation in the ordinary call

1. The evaluation will be based on:

a) Midterm exam on Electricity (3 points).

This part will be passed if the exam grade is higher or equal to 5 points out of 10.

b) Midterm exam on Waves (1.5 points).

This part will be passed if the exam grade is higher or equal to 5 points out of 10.

c) Final exam: Examination of magnetism and electromagnetic waves (4.5 points) + each student will retake the section that has failed to pass in the Midterm exams.

d) All students who pass the three exams of the subject in the first call (Waves, Electricity and Magnetism+Electromagnetic Waves) will have the final mark upgraded by multiplying it by 1.1.

e) Laboratory sessions on Electricity and Magnetism (1 point):

1. Compulsory attendance
2. Continuous evaluation in the laboratory
3. Evaluation by means of in-class tests

2. In order to pass the course it will be necessary to:

a) Perform all the laboratory practicals

b) Take all the exams

c) Obtain a minimum of 5 points as the sum of the grades of the partial exams (if released) + the final exam + practicals.

Evaluation in the extraordinary call

The marks obtained from partial evaluations on Waves, Electricity and Magnetism and Electromagnetic Waves will be kept in case the student has passed as well as the grades obtained in practicals and other activities.

The approved parts will not be kept for subsequent courses.

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STUDENT SERVICE HOURS

The sessions for answering questions and seminars to be organized during the semester will be announced in a timely manner.

BIBLIOGRAPHY AND RESOURCES

Basic BIBLIOGRAPHY

1. Tipler P.A., "Physics for Scientists and engineers", W. H. Freeman and Company, 2008. Find in the library

2. Serway R.A., "Physics", McGraw-Hill, Interamericana de México, 2013. Find in the library

3. Young - Freedman, "College Physics with Modern Physics", Volume II. Addison-Wesley, 2009. Find in the library

Complementary BIBLIOGRAPHY

1. Magro J. "Fundamentos de Electricidad y Magnetismo", García-Morato Editores, 2009. Localízalo en la bibioteca

2. Magro J. "Fundamentos de Ondas", García-Morato Editores, 2008. Localízalo en la biblioteca

3. López, E. J. "Electricity and magnetism. Theory and 84 solved problems", Garceta, 2020.

4. Fraile J. "Electromagnetismo", Garceta, 2020. Find in the Library