1. BASIC INFORMATION

Course	Physical Foundations of Engineering II
Degree program	Degree in Aerospace Engineering in Aircraft
School	Architecture, Engineering, Science, and Computation - STEAM
Year	1
ECTS	6 ECTS
Credit type	Degree Requirement
Language(s)	English and Spanish
Delivery mode	Campus based
Semester	2
Academic year	2025-2026
Coordinating professor	José Manuel López López, PhD
Professor	Asier Lambarri Martínez, PhD

2. PRESENTATION

The basic subject "Physics" is made up of two courses: Physical Foundations of Engineering I & II. They both together provide a solid foundation in the fundamental aspects of classical applied Physics. While the first-term course focuses on Mechanics; this second-term course covers mainly electric and magnetic phenomena. Additional topics include oscillations, waves, and an introduction to physical fields. The course is designed so that the student incorporates the scientific method into their way of working, always according to the “Project Based School” model, the hallmark of our School.

3. KNOWLEDGE, SKILLS, AND COMPETENCES

Knowledge

- **CON01 FB02** - Understanding and mastery of the basic concepts of the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism, and their application to solving engineering problems.

- **CON19** - Identify the knowledge of basic subjects and technologies, enabling the student to learn new methods, theories and technologies, and endowed it with great versatility to adapt to new situations (autonomous learning).
  Specific knowledge of the subject:
  - Identify the basic concepts of field theory.
  - Describe the basic principles of wave fundamentals

Skills

- **HAB01 FB01** - Ability to solve mathematical problems that may arise in engineering.
  Aptitude to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential and partial differential equations; numerical methods; numerical algorithms; statistics, and optimization.
  Specific skills of the subject:
  - Solve problems in applied physics.
  - Prepare structured and rigorous engineering reports (based on laboratory practices).
  - Solve problems in electrostatics and magnetostatics in vacuum and in material media.

Competencies

- **CP12** - Generate new ideas and concepts from known ideas and concepts, reaching conclusions or solving problems, challenges, and situations in an original way in the academic and professional environment.

- **CP13** - Convey messages (ideas, concepts, feelings, arguments), both orally and in writing, strategically aligning the interests of the various parties involved in communication in the academic and professional environment in the field of aerospace engineering.

- **CP14** - Employ information and communication technologies for data search and analysis, research, communication, and learning in the field of aerospace engineering.

- **CP15** - Influence others to guide and lead them towards specific objectives and goals, taking into consideration their viewpoints, especially in professional situations arising from the volatile, uncertain, complex, and ambiguous (VUCA) environments of the current world.

- **CP16** - Collaborate with others in achieving a shared academic or professional objective, actively participating, demonstrating empathy, and practicing active listening and respect for all team members.

- **CP17** - Integrate analysis with critical thinking in an evaluation process of different ideas or professional possibilities and their potential for error, relying on evidence and objective data that lead to effective and valid decision-making.

- **CP18** - Adapt to adverse, unexpected situations that cause stress, whether personal or professional, overcoming them and even turning them into opportunities for positive change.

- **CP19** - Demonstrate ethical behavior and social commitment in the performance of professional activities, as well as sensitivity to inequality and diversity.

4. CONTENTS

The contents of the subject cover three fields of classical physics:

- Introduction to field theory
- Electrostatics and magnetostatics in vacuum and material media
- Fundamental of waves

In more detail, these contents are organized into the following units:

Unit 1: ELECTROSTATICS IN VACUUM
Contents: Electric charge. Coulomb's force. Continuous distributions and charge density. Field lines. Application of Gauss's Law to spherical, planar and cylindrical symmetries.

Unit 2: ELECTROSTATICS IN MATERIAL MEDIA
Contents: Electrostatic energy and electric potential. Conductors in equilibrium. Dielectric constant and dielectric strength. Capacitance. Parallel-plate capacitor. Spherical and cylindrical capacitor. Systems of capacitors.

Unit 3: MAGNETOSTATICS IN VACUUM
Contents: Magnetic field and Lorentz's force. Motion of charged particles under the effect of a magnetic field. Electric currents and Ohm's Law. Magnetic force on a current-carrying conductor. Law of Biot and Savart. Applications of Ampère's Law to cylindrical symmetry.

Unit 4: INDUCTION AND MAGNETIC MATERIALS
Contents: Electromagnetic induction: Faraday-Henry Law. Lenz's law. Electromotive force. Displacement current and Maxwell-Ampère's law. Magnetic materials. Hysteresis cycle.

Unit 5: INTRODUCTION TO WAVES
Contents: Oscillations: simple harmonic motion. Definition and classification of waves. Wave equation. Plane and spherical waves. Electromagnetic waves.

5. TEACHING-LEARNING METHODOLOGIES

The types of teaching-learning methodologies used are indicated below:

- Survey of objectives and interests
- Master class
- Laboratory practices
- Group research or group problem solving
- Field experiences, conferences, visits to companies and institutions

6. LEARNING ACTIVITIES

The following table shows, for each learning activity: ***i*)** the total time the student will spend, ***ii*)** the time distribution between in-class and off-class time, and ***iii*)** the course policy about the use of artificial intelligence (AI) in that activity.

Learning activity	Total time	In-class Time	Use of AI
Lectures / masterclasses	30 hours	30 hours (100%)	Allowed
Laboratory / problem-solving workshops	12 hours	12 hours (100%)	Not Allowed
Group research and integrative group work	38 hours	18 hours (47%)	Assessed
Self-study	70 hours	0 hours (0%)	Promoted
TOTAL	**150 hours**	**60 hours (40%)**	

Further details about the AI-use policy will be published through the virtual campus platform once the course has started.

7. ASSESSMENT

Listed below are the assessment systems used and the weight each one carries towards the final course grade:

Assessment system	Weight
SE01 – Final Exam	35%
SE02 – Group Project and Lab Practices	25%
SE03 – Problem-Solving sessions	20%
SE04 – Off-class events, conferences and seminars (*)	10%
SE05 – Personal performance	10%

(*) If these activities could not be carried out, the corresponding weight would split evenly between systems SE02 and SE03.

When you access the course on the *Campus Virtual*, you'll find a description of the assessment activities you have to complete, as well as the delivery deadline and assessment procedure for each one.

7.1. First exam period

To pass the course in the first exam period, you must meet **all of** the following requirements:

- Obtain a final course grade of at least 5 out of 10 (weighted average).
- Obtain at least 4 out of 10 in the final exam (SE1).
- Comply with the minimum attendance regulations stablished by the STEAM School, whenever applicable.

In the event that **any** of the above requirements were not met, the final grade may not exceed 4.0 in a scale up to 10 (failure).

7.2. Second exam period

To pass the course in the second exam period, you must meet **both of** the following requirements:

- Obtain a final grade (weighted average) of, at least, 5 out of 10.
- Obtain a mark, at least, of 4 out of 10 in the final exam.

In the event that **any** of the above requirements were not met, the final grade may not exceed 4.0 in a scale up to 10 (failure).

The student must deliver the activities not successfully completed in the first exam period, or those that were not delivered in the first place. Further details will be given through virtual campus.

8. SCHEDULE

This table shows the delivery deadline for each assessable activity in the course:

Assessable activity	Deadline
Final exam	Last weeks of the course (17-18)
Research project defense	Week 12-15
Alternative assessment techniques	At the end of each unit

This schedule may be subject to changes for logistical reasons relating to the activities. The student will be notified of any change as and when appropriate.

9. BIBLIOGRAPHY

The main reference work for this subject is:

- Young H.D., Freedman R.A., Sears F.W. and Zemansky M.W. "*University Physics*" 14th edition (2019), Ed. Pearson.
- Tipler P.A. and Mosca G., "*Physics for Scientists and Engineers*", 6th edition (2010), Ed. W.H. Freeman.

The following high-quality resources are available on-line, free of charge:

- Feynman R., Sands M. y Leighton R., "*The Feynman lectures on Physics*", available on-line in the CalTech site: www.feynmanlectures.caltech.edu
- Schiller C., "*Motion Mountain: The adventure of Physics*", available on-line in the website of the author: www.motionmountain.net

10. EDUCATIONAL GUIDANCE AND DIVERSITY UNIT

From the Educational Guidance and Diversity Unit we offer support to our students throughout their university life to help them reach their academic achievements. Other main actions are the inclusion of students with specific educational needs, universal accessibility on the different campuses of the university, and equal opportunities.
From this unit we offer to our students:

1. Accompaniment and follow-up by means of counselling and personalized plans for students who need to improve their academic performance.
2. In terms of attention to diversity, non-significant curricular adjustments are made in terms of methodology and assessment for those students with specific educational needs, pursuing an equal opportunities for all students.
3. We offer students different extracurricular resources to develop different competences that will encourage their personal and professional development.
4. Vocational guidance through the provision of tools and counselling to students with vocational doubts or who believe they have made a mistake in their choice of degree.

Students in need of educational support can write to us at:
orientacioneducativa@universidadeuropea.es

11. ONLINE SURVEYS

Your opinion matters!

The Universidad Europea encourages you to participate in several surveys which help identify the strengths and areas we need to improve regarding professors, degree programs and the teaching-learning process.

The surveys will be made available in the “surveys” section in virtual campus or via e-mail.

Your assessment is necessary for us to improve.

Thank you very much for your participation.