Physics I

Academic Year: (2023 / 2024) **Review date: 27/04/2023 17:09:59**

Department assigned to the subject: Physics Department

Coordinating teacher: MUÑOZ CASTELLANOS, ANGEL

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 1

Branch of knowledge: Engineering and Architecture

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Physics and Mathematics at high school level (bachillerato)

LEARNING OUTCOMES

CB1. 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
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
CG1. Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CG16. Knowledge of applied thermodynamics and heat transfer. Basic principles and their application to engineering problem solving.
RA1. Knowledge and understanding: Have basic knowledge and understanding of science, mathematics and engineering within the industrial field, as well as knowledge and understanding of Mechanics, Solid and Structural Mechanics, Thermal Engineering, Fluid Mechanics, Production Systems, Electronics and Automation, Industrial Organisation and Electrical Engineering.
RA2. Engineering Analysis: To be able to identify engineering problems within the industrial field, recognise specifications, establish different resolution methods and select the most appropriate one for their solution
RA4. Research and Innovation: To be able to use appropriate methods to carry out research and make innovative contributions in the field of Industrial Engineering.
RA5. Engineering Applications: To be able to apply their knowledge and understanding to solve problems and design devices or processes in the field of industrial engineering in accordance with criteria of cost, quality, safety, efficiency and respect for the environment.

OBJECTIVES

By the end of this subject, students will be able to have:

1. Knowledge of basic physical phenomena with implications in engineering.
2. Understanding of the mathematical models that explain these phenomena.
3. Understanding and handling of the scientific method and scientific-technical language.
4. Development of reasoning techniques and strategies for analysis and problem solving.
5. Interpretation and analysis of experimental data.
6. Elementary handling of measurement devices and systems.
7. You should know the concepts of kinematics and dynamics of a particle and a system of particles, as well as the rigid solid. You will need to apply this knowledge to troubleshooting.
8. You should know the basic concepts of thermodynamics.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Kinematics of a particle
- Position, path and displacement. Speed. Acceleration, intrinsic components of acceleration
- Movement composition
- Circular motion
- Reference systems (1)
- Integration of equations of motion without explicit dependence on time

2. Dynamics of a particle
-Fundamental concepts: mass, forces, linear moment
-Newton's laws
-Examples of forces: weight, elastic force, friction...
-Angular moment and moment of forces
-Reference systems (2). Inertial forces

3. Conservative and non-conservative forces. Work and energy.
-Scalar and vector fields. Gradient and curl.
-Conservative fields. Potential function.
-Work. Power. Kinetic energy
-Conservative forces and potential energy
-Non-conservative forces.

4. Systems of particles
-Internal and external forces.
-Statics. General condition of equilibrium.
-Motion of the center of masses.
-Kinetic energy of a system of particles.
-Conservation theorems for a system of particles.

5. Kinematics of the Rigid Body
-Rotation and translation motion.
-Motion of the rigid body in the plane.
-Moment of inertia.
-Theorem of Steiner.

6. Dynamics of the Rigid Body
-Equations of motion of the rigid body
-Rotation work and power.
-Kinetic energy of rotation.

7. Introduction to Thermodynamics
-Thermodynamics: concept and definitions.
-Equilibrium States. Quasistatic processes and reversible processes.
-Work.
-Gases
-Definition of temperature
-Thermometry. Ideal gas scale
-Thermal coefficients: expansion and isotherm compressibility

8. First principle
-Experiment of Joule and statement of Helmholtz.
-Internal energy; energy equation of state.
-Heat. Heat capacities and specific heats. Heat and work sources.
-Phase Changes
-Application to ideal gases.
-Diagrams PV and PT

9. Second principle
-Statement of Kelvin-Planck. Thermal engines.
-Statement of Clausius. Refrigerating machines. Irreversibility.
-Cycle of Carnot. Theorem of Carnot. Consequences
-Cycles with ideal gases.

10. Entropy

-Theorem of Clausius. Entropy
-Diagrams T-S. Entropy in ideal gases.
-Entropy in irreversible processes. Entropy balance.

LEARNING ACTIVITIES AND METHODOLOGY

- Theoretical-practical master classes oriented to the acquisition of theoretical knowledge.
- Classes of problems in small groups with active participation of the students.
- Presentations and personal work of the student.
- Practical laboratory sessions of obligatory attendance, oriented to the acquisition of practical skills related to the program of the subject.
- The tutorial regime will be adjusted to the regulations developed by the University.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

1) Laboratory sessions (15% of final grade).
- Attendance to the laboratory sessions is compulsory, as well as the completion of the report requested for each session.
- Laboratory reports will be graded as well as the participation and attitude in the laboratory sessions.

2) Assessment during the course (25% of final grade).
- Midterm exams.
- Delivery and evaluation of any assigned homework.

3) Final exam (60% of final grade)
The exam is made at the end of the semester and it is the same for all the students.

Minimal grade in written exam to pass the course: 3.0. This requirement is independent of what the final grade might be once the different aggregate contributions are added.

BASIC BIBLIOGRAPHY

- Paul A. Tipler - Gene Mosca Física para la ciencia y la tecnología. Volumen I / Physics for scientists and engineers. V1, Reverté / W.H. Freeman.

- Raymond A. Serway John W Jewett Física / Physics, Paraninfo / Thomson .

ADDITIONAL BIBLIOGRAPHY

- David Halliday, Robert Resnick, Jearl Walker Fundamentals of physics, John Wiley and Sons.

- Douglas C. Giancoli Física : principios con aplicaciones / Physics : principles with applications, Prentice-Hall Hispanoamericana / Pearson Education International .

- Francis W Sears, Mark Waldo Zemansky, Hugh D Young, Roger A Freedman Física universitaria / University Physics, Pearson.

- Marcelo Alonso, Edward J Finn Física, Pearson Educación.

- Paul G. Hewitt Física conceptual, Addison-Wesley Iberoamericana.

BASIC ELECTRONIC RESOURCES

- University of Colorado . Phet interactive simulation: https://phet.colorado.edu/es/simulations/category/physics

- Walter Fendt . Apps on Physics: https://www.walter-fendt.de/html5/phes/