Physics I

Academic Year: (2019 / 2020) **Review date: 25-04-2019**

Department assigned to the subject: Department of Physics

Coordinating teacher: LEGUEY GALAN, TERESA

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 1

Branch of knowledge: Engineering and Architecture

COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.

The goal of this course is that the student can understand the physical phenomena involved in Classical Mechanics and Thermodynamics.

In order to achieve this goal, the following competences and skills have to be acquired
- Ability to understand and know basic concepts of mechanics and thermodynamics.
- Ability to understand and use the mathematics involved in the physical models.
- Ability to understand and use the scientific method.
- Ability to develop skills to solve problems.
- Ability to use scientific instruments and analyze experimental data.
- Ability to retrieve and analyse information from different sources.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Kinematics of a particle I.
- Vectors position, velocity and acceleration.
- Motion in 2 and 3 dimensions.Equation of trajectory. Projectile motion.

2. Kinematics of a particle II.
- Intrinsic components of acceleration (normal and tangential accelerations).
- Circular motion.
- Transformations among systems of reference. Relative motion.

3. Dynamics of a particle I.
- Mass. Linear momentum. Force
- Newton´s laws. Equations of motion.
- Examples of forces: weight, elastic force, tension, contact forces.

4.Dynamics of a particle II.
- Forces in linear accelerated systems and circular motion.
- Angular momentum. Moment of forces.

5. Conservative and non-conservative forces. Work and energy.
- Work. Power. Kinetic energy.
- Conservative forces and potential energy.
- Non-conservative forces.

6. Systems of particles.
- Internal and external forces.
- Kinetic energy of a system of particles.
- Conservation theorems for a system of particles.
- Motion of the Center of mass.
- Collisions.

7. Kinematics of the Rigid Body.
- Motion of the Rigid Body in the plane.
- Moment of Inertia.
- Theorem of Steiner.

8. Dynamics of the Rigid Body.
- Angular momentum of the rigid body.

- Plane motion equations.
- Work of forces acting on a rigid body. Kinetic energy.

9. Introduction to Thermodynamics. Temperature.
- Thermodynamics: concepts and definitions.
- Pressure.
- Definition of temperature. Zeroth Law.
- The Ideal-Gas Law.

10. Thermal properties of pure substances. Heat.
- Thermal coefficients: expansion and isotherm compressibility.
- Heat. Heat capacities and specific heats.
- Phase Diagrams. Phase Changes. Latent Heat.

11. First Law of Thermodynamics
- Work
- Internal Energy.
- First Law of Thermodynamics.
- Application to ideal gases.

12. Second Law of Thermodynamics.
- Statement of Kelvin-Planck. Heat engines.
- Statement of Clausius. Refrigerating machines. Irreversibility.
- Cycle of Carnot. Theorem of Carnot. Consequences.
- Cycles with ideal gases.
- Entropy.

LEARNING ACTIVITIES AND METHODOLOGY

- Lectures where the theoretical concepts are explained
- Discussion sessions and activities in groups (~ 2-3 people) to solve problems:
  The main skills to be acquired in these activities are:
  - To understand the statement of a problem
  - To identify the physical phenomenon involved in the statement and the physical laws involved
  - To develop an strategy to reach the objective (for instance breaking the problem in small subproblems)
  - To be able to make a critical analysis of the results (is the final number sensible?, are the dimensions consistent?)
- Laboratoy sessions (~20 students divided in 2 people groups)
  The main skills to be developed in this activity are:
  - To understand that physics is an experimental science and they can reproduce the laws that have been theoretically explained in the lectures
  - To use scientific instruments and to be careful in its operation
  - To be careful in the acquisiton of experimental data
  - To learn the basis for the management of a scientific data set
  - To be able to write a report with the main results of the experiment
  - To be able to discuss in a critical way the experimental results.

ASSESSMENT SYSTEM

1) Laboratory sessions (15% of final mark)
Attendance to the laboratory sessions is compulsory.
Evaluation of the reports. The mark is shared by the members of the group.

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

3) Final exam (60% of final mark)
The exam is made at the end of the semester and it is the same for all the students
Contents:Problems and/or short theoretical questions to be solved covering the topics of the program

The minimum required grade in the final exam is 3/10.

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

BASIC BIBLIOGRAPHY

- Serway & Jewett Physics for Science and Engineering, Thomson.
- Tipler &Mosca Physics for Scientists and Engineers, MacMillan.
- Young & Freedman University Physics with modern Physics, Pearson.

ADDITIONAL BIBLIOGRAPHY

- Bedford & Fowler Engineering Mechanics: Statics & Dynamics, Pearson.
- Beer & Johnston Vector Mechanics for Engineers, McGraw-Hill.
- Cengel & Boles Thermodynamics: An Engineering Approach, McGraw-Hill.