Foundations of Physics

Academic Year: (2022 / 2023) **Review date: 21/06/2022 15:12:26**

Department assigned to the subject:

Coordinating teacher: TARDIO LOPEZ, MIGUEL MODESTO

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 1

OBJECTIVES

Basic and general competencies:

Knowledge of basic physical phenomena with engineering implications.
Understanding of mathematical models that explain these phenomena.
Understanding and management of the scientific method and scientific-technical language.
Development of techniques and strategies for the analysis of reasoning and problem solving. Interpretation and analysis of experimental data.
Elemental device management and measurement systems.

DESCRIPTION OF CONTENTS: PROGRAMME

Objective of Physics: Physical magnitudes. Measurement processes. Scalar and vector magnitudes. Dimensional analysis. Unit conversion. Error theory introduction.

Particle kinematics: Velocity and acceleration. Linear, planar and space motion. Rotation. Acceleration intrinsic components.

Particle Dynamics: Newton¿s Laws. Linear momentum. Inertial and gravitational mass. Weight. Centre of gravity. Forces (friction and tension): springs; strings and ropes; Friction force: dynamic and static. Motion equations.

Work and Energy: Momentum. Conservative and non-conservative forces. Potential energy. Central forces. Angular momentum.

Rigid-body Kinematics and Dynamics: Centre of mass and gravity. Centre of mass reference system. Energy, system of particles linear and angular momentum. Rigid-body angular momentum. Force momentum. Angular velocity and acceleration. Rotation kinetic energy. Rotation work and energy. Relative motion. Rigid-body translation and rotation. Non-inertial systems. Centripetal and centrifugal forces. Rigid-body motion equation.

Electricity: Electric charge. Coulomb¿s Law. Electric field concept. Electric field lines. Point charge electric field. Superposition theorem: point charges. Electric flux. Gauss Theorem. Electric potential energy and difference of potential. Electric field-potential relationship. Potential surfaces. Electric nature of matter. Conductors and dielectrics. Capacitors. Electric current. Ohm¿s Law. Joule¿s effect. Electromotive force.

Magnetism: Magnetic field definition. Lorentz¿s Law applied to a point charge. Point charge motion in a magnetic field. Applications. Magnetic force over electric currents. Electric currents as magnetic field sources. Biot and Savart Law. Ampère¿s Law. Forces between currents. Magnetic flux. Magnetism in matter: Magnetic materials.

Electromagnetism: Faraday¿s Induction Law. Lenz¿s Law. Self-induction and induction in currents. Inductance. Magnetic energy. Alternating currents. Effective electromotive force and intensity. Power. Maxwell equations. Electromagnetic waves introduction. Electromagnetic waves interpretation. Plane

electromagnetic waves. Electromagnetic spectrum. Electromagnetic energy.

Macroscopic matter: Classic thermodynamics. Basic study about matter structure. Gas, solids, and liquids. Hydrostatic. Thermodynamics systems. Thermodynamics. Temperature and heat. Thermodynamics initial principle. Thermometers and thermal scales. Pression. Manometers. Kinetic gas theory. Thermodynamics first principle. Energy equipartition. Thermodynamics second principle. Specific heat. Reversibility and Carnot cycle. Absolute temperatures. Entropy and Second Principle.

Microscopic matter: Atomic model introduction. Atomic spectra. Bohr¿s model. Hydrogen atom quantic model. Quantic numbers physical interpretation. Nucleus properties. Radioactivity. Half-life. Radioactive decay.

LEARNING ACTIVITIES AND METHODOLOGY

Master classes where theoretical concepts are explained, and academic exercises are solved (2.0 ECTS).

The following information will be provided one week in advance: brief theoretical concepts of the session; bibliography list, including charters or sections related to the concepts covered in the lecture.

Classes in small groups where the theoretical concepts will be applied to problem solving (3.2 ECTS).

These sessions are focused on solving exercises, addressed to apply and understand the main concepts presented in the Master classes. Periodic individual work will also be revised.

The objective of these sessions is developing the following skills:

Understanding the exercise text (for instance, drawing a scheme of the data).
Identifying the physical phenomena and laws included in the exercise.
Developing skills to solve the exercise (for instance, dividing the exercise in smalls tasks).
Being careful when using the math required to solve the exercise.
Analyzing if the obtained result makes sense (do the units make sense?)
Submitting and defending the result and solution of personal-work, periodic exercises.

Practical laboratory sessions (0.2 ECTS).

The main skills involved are:

Understanding that Physics is a fundamental science and that the concepts learnt in the Master Classes can be reproduced in the laboratory.
Using scientific devices and learning to be careful when using them.
Learning to take experimental data in a rigorous way.
Learning the basics of data treatment.
Making a report that includes the taken data and their analysis.
Making a critical analysis of the results (is the objective of the practice achieved?).

Mid-term exams and/or final exam (0.6 ECTS).

Tutorials: 1-hour session for each master and small-group class.

ASSESSMENT SYSTEM

Knowledge, abilities and skills are assessed along the semester, accounting for a 60% of the final mark. The periodic individual exercises must be solved and submitted before the deadlines shown in the course Schedule, counting 30% of the final mark. Compulsory laboratory report counts 10% of the final mark.

The 60% contribution of the subject corresponding to the exams can be achieved with the final exam or with the three mid-term exams, each of them considered positive if at least a score of 3 over 10 is achieved.

BASIC BIBLIOGRAPHY

- TIPLER, P. A. y MOSCA, G Física para la ciencia y la tecnología, volumen I (6a edición, en 2 volúmenes), Editorial Reverte¿, Barcelona, 2010

- TIPLER, P. A. y MOSCA, G. Física para la ciencia y la tecnología, volumen II (6a edición, en 2 volúmenes)., Editorial Reverte¿, Barcelona, 2010

ADDITIONAL BIBLIOGRAPHY

- HALLIDAY, D.; RESNICK, R.; WALKER, J. Fundamentos de Física (6a edición, 2 volúmenes)., Editorial CECSA. Me¿xico, 2003

- SERWAY, R. A.; JEWETT, J. W Física para ciencias e ingenierías (6a edición, volumen 1)., Thomson, Madrid, 2006

- TIPLER, PAUL A.; LLEWELLYN, RALPH A MODERN PHYSICS, Editorial W. H. Freeman and Company (5th Edition) , ..