Physic II

Academic Year: (2023 / 2024) **Review date: 25-04-2023**

Department assigned to the subject: Physics Department

Coordinating teacher: GONZALO MARTIN, ALICIA

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 2

Branch of knowledge: Engineering and Architecture

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

- Trigonometry
- Linear Algebra
- Calculus I
- Physics I (mechanics)

OBJECTIVES

Upon successful completion of this subject, students will be able to:
1.- Have knowledge and understanding of the physical principles of electricity and magnetism.
2.- Have the ability to apply their knowledge and understanding to identify, formulate and solve problems of electricity and magnetism using established methods.
3.- To have the ability to design and carry out experiments on electricity and magnetism, to interpret the data obtained, and draw conclusions from them.
4.- Have skills in handling laboratory equipment for data collection in electricity and magnetism practices.
5.- Have the ability to select and use appropriate tools and methods to solve problems of electricity and magnetism.
6.- Have the ability to combine theory and practice to solve problems of electricity and magnetism.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Coulomb's law. The electric field.
 1.1- Electric charge.
 1.2- Coulomb's law. Dimensions and units. The superposition principle.
 1.3- Definition of the electric field.
 1.4- Electric field of point charges.
 1.5- Superposition principle. Electric field lines.

2. Gauss's law.
 2.1- Charge densities. Electric field due to different charge distributions.
 2.2- Electric flux.
 2.3- Gauss's law.
 2.4- Application of Gauss's law to calculate electric fields.

3. Electric potential.
 3.1- The work done by an electric field on a moving point charge.
 3.2- Electric potential difference and electric potential.
 3.3- Electric potential due to different charge distributions.
 3.4- Relationship between electric field and electric potential. Equipotential surfaces.
 3.5- Electrostatic potential energy of point charges inside an electric field.

4. Conductors.
 4.1- Conductor and insulator materials; microscopic interpretation. Conductors in electrostatic equilibrium.
 4.2- Properties of conductors in electrostatic equilibrium.
 4.3- Charge distribution. Electric field and electric potential in a conductor.
 4.4- Electric field inside charged conductors. Conductors with charge inside a cavity.

5. Dielectrics: Capacitance and energy storage.

5.1- Dielectrics materials and dielectric constant.
5.2- Definition of a capacitor.
5.3- Calculation of capacitance.
5.4- Combination of capacitors.
5.5- Capacitors with dielectrics.
5.6- Breakdown voltage. Storing energy in a capacitor.

6. Electric current
6.1- Electric current: Intensity and current density.
6.2- Ohm's law. Electric resistance. Conductivity and resistivity of materials.
6.3- Joule's law. The power dissipated in an electric conductor.
6.4- Electromotive force (emf). RC circuits. Charging and discharging a capacitor.

7. Magnetic forces and magnetic fields.
7.1- Definition of a magnetic field. Magnetic flux. Non-existence of magnetic monopoles.
7.2- Lorentz's force over a charged particle.
7.3- Charged particle movement in a uniform magnetic Field. Applications: Velocity selector, mass spectrometer.
7.4- Current diferential. Magnetic force over currents.
7.5- Torque on magnets and current loops in a constant magnetic field. Magnetic moment.

8. Sources of magnetic field and magnetic materials.
8.1- Current as a source of the magnetic field: Biot-Savart's law.
8.2- Forces between currents. Example of two current-carrying parallel wires.
8.3- Ampère's law.
8.4- Magnetic behavior in matter. Ferromagnetism, paramagnetism, diamagnetism.

9. Faraday's law of induction.
9.1- Faraday's law of induction. Lenz's law.
9.2- Induced electromotive force. Examples of electromagnetic induction: generators, transformers...
9.3- Self-induction and mutual induction. Solenoid example.
9.4- Energy stored in a magnetic field.

10. Maxwell's equations: Electromagnetic waves.
10.1- Displacement current: Corrected Gauss´s law for magnetism.
10.2- Completed Maxwell's equations.
10.3- Introduction to oscillatory movement. Armonic waves. One-dimension wave equation.
10.4- Plane electromagnetic waves. Energy of an electromagnetic wave.

LEARNING ACTIVITIES AND METHODOLOGY

THEORETICAL PRACTICAL CLASSES.
Knowledge and concepts students must acquire. Students receive course notes and will have basic reference texts. Students partake in exercises to resolve practical problems. The format will be:

1) Theoretical lessons.
2) Small lessons groups.

LABORATORY SESSIONS.
Subjects with 6 credits have 8 lab hours 100% of presenciality.

TUTORING SESSIONS.
Individualized office hours (individual tutoring) or in-group (group tutoring) for students with a teacher, acording to University rules.

STUDENT INDIVIDUAL WORK OR GROUP WORK.
Subjects with 6 credits will have a dedication of 98 hours.

ASSESSMENT SYSTEM

1- Final written exam (60% of final mark).
Problems to be solved covering the topics of the program, including short theoretical questions.

2- Continous assessment (40% of final mark).
- Short test exams during the course (25% of the final mark).
- Laboratory sessions (15% of final mark).
    * Attendance at the laboratory sessions is compulsory.
    * Evaluation of the reports. The mark is shared by the members of the group.

MANDATORY EVALUATION CRITERIA:
- Attendance and participation in all laboratory sessions is mandatory, as well as delivery of the corresponding reports.
- Students must get a minimum grade of 3 pts, over a maximun of 10 pts, in the final written exam.

Failure to meet these two criteria will result in a failing grade (F: Suspenso) for the course.

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

BASIC BIBLIOGRAPHY

- P. A. Tipler and G. Mosca Physics for Scientists and Engineers , W.H. Freeman and Company, 2004, 2004

ADDITIONAL BIBLIOGRAPHY

- BURBANO S. BURBANO E. Y GARCIA Problemas de Física, Ed. Mira..
- GASCÓN, BAYÓN y col Electricidad y Magnetismo, ejercicios y problemas resueltos., Pearson Educación, 2004