Physic II

Academic Year: (2022 / 2023) **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 Energy of Point Charges.

4. Conductors.
 4.1 Conductor and Insulator materials; microscopic interpretation.
 4.2 Properties of conductors in Electrostatic Equilibrium.
 4.3 Charge distribution. Electric Field and Electric Potential in a conductor.
 4.4 Electric Fields inside charged conductors. Conductors with charge inside a cavity.

5. Dielectrics: Capacitance and Energy Storage in electric Fields.

5.1 Dielectrics and dielectric constant.
5.2 Definition of Capacitor.
5.3 Calculation of capacitance.
5.4 Combination of Capacitors.
5.5 Capacitors with Dielectrics.
5.6 Storing energy in a Capacitor. Energy density of the electric Field.

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. 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. Lorentz-s Force.
7.2 Charged Particle Movement in a uniform Magnetic Field. Applications: Velocity selector, Mass Spectrometer.
7.3 Magnetic Force on a dipole and on a Current-Carrying conductor wire.
7.4 Torque on a dipole and Current Loop in a constant magnetic field, Permanent Magnets. Magnetic Moment.

8. Sources of Magnetic Field and Magnetic Materials.
8.1 Sources of the Magnetic Field: Current elements. Biot-Savart Law.
8.2 Forces Between Two Current-Carrying parallel wires.
8.3 Magnetic Flux.
8.4 Ampère-s Law.

9. Faraday's Law of Induction.
9.1 Faraday's Law of Induction. Lenz-s Law. Applications.
9.2 Motional Electromotive Force. Examples of Electromagnetic Induction.
9.3 Mutual Induction and Self-Induction. Energy Stored in a Solenoid.
9.4 Energy Stored in a Magnetic Field.

10. Oscillations. Maxwell's Equations: Electromagnetic Waves
10.1 Introduction to the oscillatory movement. Mathematical description of the oscillatory systems.
10.4 Displacement Current: Gauss´s Law for Magnetism: Maxwell's Equations. Plane Electromagnetic Waves. Energy Flux Density of an Electromagnetic Wave.

LEARNING ACTIVITIES AND METHODOLOGY

THEORETICAL PRACTICAL CLASSES.
Knowledge and concepts students must acquire. 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.

TUTORING SESSIONS.
Individualized attendance (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 have 98 hours.

ASSESSMENT SYSTEM

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

2- Continous assesement (40% of final mark).
- Short test exams during the course (25% of the final mark).
- 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.

Mandatory evaluation criteria:
- Attendance and participation in all laboratory sension is mandatory.
- Students must get a minimun grade of 3 pts, of a maximun of 10 pts, in the end of term examination.
Failure to meet this 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

- LEA SM. & BURKE JR. La Naturaleza de las Cosas volumen 1 y 2, Paraninfo, Thomson Learning., 2001
- SEARS, ZEMANSKY, YOUNG & FRIEDMAN Física Universitaria, vol. 1-2, 9ª edición, Ed. Addison-Wesley, 1999
- SERWAY, RA & JEWETT, JW. Física, Volumen 1 -2, Ed Thomson, 2003
- TIPLER, PA & MOSCA, G. Volumen 1 - 2., Ed Reverté, 2005

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