THEORY OF ELECTRICITY

Code: 322119

Main Scientific Area: Electronics and hardware

Lecturer: Diogo Albano Teixeira Gomes

Language of Instruction: Portuguese

Regime: S1

Contact Hours: 60h Total Workload: 108h

ECTS: 6,0

Objectives

This curricular unit presents the concepts implicit in electrical and electromagnetic phenomena.

The aim is thus to enable students to better understand electrical phenomena, either by learning skills to analyze electrostatic and electromagnetic actions, or by applying the theoretical concepts presented to real situations.

Learning Outcomes

Students who successfully complete this course should be able to:

Know and apply the concepts underlying the theory of electric fields and magnetic fields;
Understand, distinguish and apply the basic laws implicit in electromagnetic fields;
Apply the theoretical concepts presented in solving real problems.

Course Contents

Electric Fields

Electric charge as a property of material
Conductors and insulators

Coulomb's Law

Electrical Field
Electrical Field of a Continuous Distribution of Charges
Electric Field Lines

Motion of Charged Particles in a Uniform Electric Field

Gauss' Law

Electric flow
Gaussian Law
Applications of Gauss' Law to Charged Insulators
Conductors in Electrostatic Balance

Electric potential

Difference of Potential (Voltage) and Electrical Potential
Potential Differences in a Uniform Electric Field
Electrical Potential and Potential Energy of Point Charges
Electrical Potential of Continuous Charge Distributions
Potential of a Charged Conductor
Calculation of the electric field from the Electric Potential.

Capacity and Dielectrics

Capacity Definition
Calculation of the Capacity of a Capacitor
Copacytor Combinations
Parallel Connection
Serial Connection
Energy from a Charged Capacitor
Capacitor with Dielectrics

Currents and Resistance

Electric current
Resistance and Ohm's Law
The Resistivity of Different Conductors
Electrical Field
Electrical Field of a Continuous Distribution of Charges
Electric Field Lines
Superconductors
A Model for Electric Conduction
Electric Energy and Electric Power.

Series and Parallel Resistors

Kirchhoff's Laws

RLC circuit analysis

sinusoidal alternating current

Period, frequency and phase

Electrical Instruments Production of alternating voltages

Simple and compound voltages

Connection of three-phase receivers

Magnetic Fields

Definition and properties of the magnetic field
Magnetic force in a conductor carried by an electric current
Momentum over a loop of current in a uniform magnetic field
Motion of a charged particle in a magnetic field

Magnetic Field Sources

The Law of Biot-Savart
The Magnetic Force between two Conductors
Ampere's Law
The Magnetic Flux
The Gaussian Law of Magnetism

The Magnetic Field of a Solenoid

Faraday's law

The Faraday Law of Induction
The f.e.m. of induction on a moving conductor
The Law of Lenz
Induced Females and Induced Electric Fields
Generators and Engines
Maxwell's Equations

Inductance

Self-Inductance
RL Circuits
Energy in a Magnetic Field
Mutual Inductance

Recommended Bibliography

Villate, J. (1999, 2015).Electromagnetismo. Mc-Graw Hill.

Pollack, G. and Stump D. (2001). Electromagnetism. Addison Wesley.

Edminister, J. (1994, 2014). Electromagnetics, 2nd Edition, Mc-Graw Hill.

Learning and Teaching Methods

The syllabus is presented in order to explore in a sustained way the topics needed to complement the trainingstudents in the field of circuit analys and electrotechnis seeking to deepen concepts related areas of majorimportance to the design activities of electronic circuits and alternated current systems. The content of theproposed syllabus addresses the various aspects essential to the fulfillment of these objectives, particularly inrespect to current topics and recent developments.

Assessment Methods

The continuous evaluation will be obtained by performing 2 written Tests with equal weight of 35% each inobtaining the final result, requiring a minimum grade of 7 values in each one and a practical / research work,including its

presentation, with a weight of 30% in obtaining the final result, being also required a minimum grade of7 values.

The approval will be obtained with a final result of 9.5 or more.

In case of not obtaining the approval in the continuous evaluation, the student can carry out the examination ofresource with a weight of 70% in obtaining the final result.