INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Applied Electrotechnics			Field of study	Technological Processes		
Bachelor in	Industrial Management and Engineering			School	School of Technology and Management		
Academic Year	2022/2023	Year of study	1	Level	1-1	ECTS credits	6.0
Type	Semestral	Semester	2	Code	9104-754-1203-00-22		

Workload (hours)	162	Contact hours	T -	TP 60	PL -	TC -	S -	E -	OT -	O -

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s): João Paulo Ramos Teixeira, Luís Manuel Montenegro de Araújo Pizarro

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Apply the proper concepts and fundamental laws related to Electrostatics and Electromagnetism.
2. Model and dimensioning Electrostatics and Magnetostatics systems.
3. Understand the concepts and fundamental laws of DC and AC.
4. Apply properly the fundamental techniques analysis of circuits in DC and AC.
5. Discuss practical applications of some basic components and systems used in the field of Electrical Engineering.

Prerequisites

Before the course unit the learner is expected to be able to:
Know the basic mathematical formalisms.

Course contents

Mathematical revisions. Electrostatics. The energy. Direct current. Alternate current. Electromagnetism. Basics notions of electric machines.

Course contents (extended version)

1. Electrostatics
   - General concepts and electric charge.
   - Force, potential and electric field.
   - Work and potential energy.
2. Direct current
   - Ohm's and Joule´s laws.
   - Electric resistance and resistances association.
   - Electric power.
   - Real and ideals tension and current sources.
   - Association and equivalence of sources.
   - Kirchhoff's laws. Matrix methods for complex circuits resolution.
   - Superposition theorem, Thévenin and Norton theorems.
   - Duality and equivalence.
   - Transient and forced response.
3. Alternating current
   - Steinmetz transform.
   - Ohm's law, induction and charge laws.
   - Impedance, admittance and power factor.
   - Series and parallel RLC circuits.
   - Kirchhoff's Laws and matrix methods for complex circuits resolution.
   - Superposition theorem and Thévenin and Norton theorems.
   - Active, reactive and apparent power.
   - Series and parallel resonance.
   - Power factor correction.
4. Electromagnetism
   - Magnetic field and magnetic flux.
   - Magnetic and electromagnetic circuits.
   - Laplace´s, Faraday´s and Lenz´s laws.
   - Electromagnetic induction.
   - Eddy currents.
   - Self-induction and mutual induction, ferromagnetism and hysteresis.
   - Maxwell's equations.
5. Basics notions of electric machines
   - General concepts and practical examples.
   - Functional characteristics of existing equipment in a laboratory.

Recommended reading

1. Introdução à Teoria da Electricidade e do Magnetismo, N Martins, Editora Edgard Blucher Ltda, 1990
2. Engineering Circuit Analysis, WH Hayt, JE Kemmerly, International Student Edition, McGRAW-HILL, 8th ed., 2011
3. Engineering Electromagnetics, WH Hayt, McGRAW-HILL International Book Company, 6th ed., 2001
4. Electricity and Magnetism, EM Purcell, Berkeley Physics Course, vol.2, McGRAW-HILL International Editions, 3rd ed., 2013
5. O'Malley, John, "Análise de Circuitos", McGraw- Hill, 1983

Teaching and learning methods

Theoretical classes: presentation of the course contents supported on illustrative examples. Practical classes: Problem-solving and execution of laboratorial works.

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 60%
   - Laboratory Work - 40% (Laboratory works with report presentation)
2. Alternative 2 - (Student Worker) (Special)

Assessment methods

- Final Written Exam - 100%

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

João Paulo Ramos Teixeira, Luís Manuel Montenegro de Araújo Pizarro	José Luís Sousa de Magalhaes Lima	António Jorge da Silva Trindade Duarte	José Carlos Rufino Amaro
21-03-2023	22-03-2023	24-03-2023	25-03-2023