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| Course Unit | Power Electronic Converters and Applications | Field of study | Energy |
| Bachelor in | Renewable Energy Engineering | School | School of Technology and Management |
| Academic Year | 2021/2022 | Year of study | 2 |
| Level | 1-2 | ECTS credits | 6.0 |
| Type | Semestral | Semester | 2 |
| Code | 9910-743-2201-00-21 | | |

| Workload (hours) | 162 | Contact hours | T | TP | PL | TC | S | E | OT | O |
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| | | | 30 | 15 | 15 | - | - | - | - | - |

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): Américo Vicente Teixeira Leite

## Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Describe the operation of basic power electronic converters based on the most commonly used Power Electronic Swiches;
2. Implement and analyse in the laboratory, with a good level of autonomy, power electronic converters, in simple applications (electric scooter).
3. Analyse the operation of power electronic converters using the PWM technique and simulation tools.

## Prerequisites

Before the course unit the learner is expected to be able to:
1. Understand single and three-phase electric circuits;
2. Analyse basic electronic circuits.

## Course contents

General description of power semiconductor devices. Introduction to power electronic converters: converters from direct current to direct current (DC/DC) – step-down (Buck), step-up (Boost), and Buck-Boost and full-bridge; converters from direct current to alternating current (DC/AC) – single- and three-phase voltage source inverters; AC/DC converters – single- and three-phase diodo and thyristor rectifiers.

## Course contents (extended version)

1. Fundamental characteristics of the main power semiconductor devices as electronic switches:
   - Diodes and thyristors;
   - Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFETs);
   - Insulated-Gate Bipolar Transistors (IGBTs).
2. Introduction to the power electronic converters:
   - Converters (DC/DC): Step-down (Buck) ; Step-up (Boost); Buck-Boost and Full-bridge converter;
   - Converters from direct current to alternating current: single and 3-phase voltage source inverter;
   - AC/DC converters – single- and three-phase diodo and thyristor rectifiers.
3. Application of power converters in electric vehicles and with renewable energy sources.

## Recommended reading

1. Power Electronics. Converters, Applications and Design, N. Mohan, T. Undeland, W. Robbins, 3rd Edition, John Wiley and Sons, 2003;
2. Introduction to Power Electronics, Daniel W. Hart, Prentice-Hall, 1997;

## Teaching and learning methods

Learning outcomes 1: teamwork - analysis and discussion of the results of laboratory and simulation activities;
Learning outcome 2: teamwork - practical and laboratory activity;
Learning outcome 3: teamwork - simulation activity.

## Assessment methods

1. Continuous assessment - (Regular, Student Worker) (Final)
   - Work Discussion - 100% (Attitude and performance, discussion, activities and project: peer assessment - 100%)
2. Final exam - (Regular, Student Worker) (Supplementary, Special)
   - Final Written Exam - 100% (Written component - 40%; Practical and laboratory component - 60%)

## Language of instruction

Portuguese, with additional English support for foreign students.

## Electronic validation

| Américo Vicente Teixeira Leite | José Luís Sousa de Magalhaes Lima | Ana Maria Alves Queiroz da Silva | Paulo Alexandre Vara Alves |
|---|---|---|---|
| 15-03-2022 | 20-03-2022 | 21-03-2022 | 21-03-2022 |