

Course Unit	Power Electronic Converters		Field of study	Electronics and Instrumentation	
Bachelor in	Electrical and Computers Engineering		School	School of Technology and Management	
Academic Year	2025/2026	Year of study	3	Level	1-3
Type	Semestral	Semester	2	ECTS credits	6.0
Code	9112-852-3201-00-25				
Workload (hours)	162	Contact hours	T -	TP 30	PL 15
			TC -	S -	E -
			OT 15	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) **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 the most commonly used power electronic converters based using PWM control.
2. Simulate and analyse the operation of power electronic converters, using simulation tools;
3. Implement and analyse in the laboratory, with a good level of autonomy, power conversion projects: DC/DC buck-boost converter; 4 quadrant DC/DC converter; single-phase voltage source inverter.

Prerequisites

Before the course unit the learner is expected to be able to:

1. Know the main power semiconductor devices widely used and typical driver circuits;
2. Understand direct and alternating current (single-phase and three-phase) circuits.

Course contents

Analysis of power electronic converters – circuits, control and applications: converters from direct current to direct current (DC/DC); converters from direct current to alternating current (DC/AC) – single- and three-phase voltage source inverters; AC/DC converters – single- and three-phase diode and thyristor rectifiers; AC/AC converters; control methods; harmonic spectrum; applications, namely in electrical drives and with renewable energy sources.

Course contents (extended version)

1. Analysis of power electronic converters:
 - Converters DC/DC: Buck (step-down), Boost (step-up), Buck-Boost, full bridge;
 - Converters DC/AC: single- and three-phase voltage source inverters;
 - AC/DC converters – single- and three-phase diode and thyristor rectifiers;
 - AC/AC (AC-DC-AC) converters;
 - Control methods and harmonic spectrum;
 - Pulse Width Modulation (PWM) controllers based on dedicated integrated circuits.
2. Applications of power converters in electrical drives and with renewable energy sources.

Recommended reading

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

Teaching and learning methods

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

Assessment methods

1. Peer assessment - (Regular, Student Worker) (Final)
 - Work Discussion - 50% (Evaluation of LO 1 and 2 based on written criteria.)
 - Laboratory Work - 50% (Evaluation of LO 3 based on written criteria. The overall average is assigned by the teacher.)
2. Final exam - (Regular, Student Worker) (Supplementary, Special)
 - Final Written Exam - 100% (Written component - 50%; Practical and laboratory component - 50%)

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

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23-02-2026	02-03-2026	02-03-2026	06-03-2026