UNIVERSIDAD PONTIFICIA ICAI ICADE COMILLAS MADRID
ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA

DEA-GITT-423 Power Electronics

SEMESTER: Spring

CREDITS: 4.5 ECTS (3 hrs. per week: 2 Theory + 1 Lab, on average)

LANGUAGE: English

DEGREES: GITT

Course overview

This course is an introduction to the use of power electronics in information technologies. It focuses on DC-to-DC conversion (analysis, design and performance) but it also addresses the importance of electrical energy engineering, AC-to-DC conversion, DC-to-AC conversion, energy storage, energy supply to remote loads and electromagnetic compatibility.

Prerequisites

Elementary theory of DC and AC circuit analysis and basic knowledge on Fourier series

Course contents

Theory:

1. Introduction: energy in information technologies and power electronics.
2. DC-DC converters: buck, boost and buck-boost converters; fully controllable solid-state switches; galvanic isolation in DC-DC converters; DC power supplies, diodes and transistors.
3. AC-DC converters. Single-phase diode rectifiers. Single-phase fully controlled rectifiers. Thyristors.
4. Fundamentals of electrical engineering. Phasors, harmonics, power factor and THD in power systems.
5. DC-AC converters. Square wave and Pulse Width Modulation control mode. Active- and reactive-power control, fundamentals of distributed generation.
6. Auxiliary topics: Supplying remote loads. Average modelling of DC-DC converters. Control circuits in power electronics. Electromagnetic compatibility.

Laboratory:

There will be five 2-hour sessions.

P1. Simulation on power electronics. DC-to-DC converter in open loop.

P2. Simulation. DC-to-DC converter in closed loop.
P3. Experimental analysis of a DC-to-DC converter in open loop.
P4. Experimental analysis of a DC-to-DC converter in closed loop.
P5. AC-to-DC converter + DC-to-DC converter: towards a power supply.

Textbook

- D.H. Hart. Power Electronics. McGraw-Hill, 2010.

Grading

The overall grade is obtained as follows:

- Final exam: 50%. A two-and-a-half-to-3-hour exam.
- Quizzes: 20%. Two or three 50-minute quizzes.
- Lab notebook 15%.
- Individual contribution: 15%. Homework, laboratory work and skills shown, evaluation of laboratory work through individual questions, etc.