Curricular Unit Sheet

1. Curricular Unit Syllabus.

1.1. Curricular Unit

Power Converters and Electrical Drives

1.2. Scientific area acronym

EE

1.3. Duration

Semester

1.4. Total of Working Hours

162

1.5. Contact hours

T (22,5) + TP (22,5) + PL (22,5) = 67,5

1.6. ECTS

6

1.7. Observations

Optional

2. Responsible Academic staff and lecturing load in the curricular unit (enter full name)

Paulo José Duarte Landeiro Gambôa	9 hours

3. Other academic staff and lecturing load in the curricular unit

Miguel Cabral Ferreira Chaves	3 hours

4. Learning outcomes of the curricular unit

- This course aims to equip students with knowledge on systems using variable speed electrical machines controlled by power inverters;
- Knowing select and use static power converters to power different types of electrical machines and namely project the respective control systems, so in integrated form, performing electromechanical actuators;
- Learn to implement advanced control systems with digital controllers refuse to signal;
- Learn to design and scale and electromechanical actuators and their control.

5. Syllabus

- Modelling of stationary and dynamic behavior of mechanical systems (reducing couplings and brakes);
- Classification, characterization and modeling of different static power converters;
- Techniques for regulating the torque, speed and position using machines with DC, synchronous and asynchronous;
- Typical problems in control actuators;
- Control drives with DC machines, synchronous and asynchronous.

Laboratory work:

- Drives with Direct Current Machines - Speed Control (with digital signal controller);
- Asynchronous Three-Phase Drives with machines - Change of Command for Voltage and Frequency (V/f) for guidance and control field (with digital signal controller);
- Field orientation control for a permanent magnet synchronous motor for industrial inverter;
- Scalar control (V / f) for field orientation and torque (DTC) of an asynchronous motor for industrial inverter.

6. Demonstration of the syllabus coherence with the curricular unit's objectives

- Using numerical simulation programs (Matlab/Simulink) with their mathematical models to reproduce the main types of electric drives;
- Conducting laboratory tests on electric drives;
- Presentation and discussion with students in practical cases.

7. Teaching methodologies (including evaluation)

- The theoretical and Theoretical/Pratical grade, T, is is obtained with the correction of problems and research works. This grade must be equal or greater than 9,5 (nine point five values), in a 20-point grading scale, in order to obtain approval at the curricular unit;
- The practical grade, P, is the assigned to the practical reports, and the formative evaluation, assigned by the laboratory class teacher. This grade must be equal or greater than 9,5 (nine point five values), in a 20-point grading scale, in order to obtain approval at the curricular unit;
- The unit final grade, FG, is given by $2/3 \times T + 1/3 \times P \geq 10$

8. Demonstration of the coherence between the teaching methodologies and the learning outcomes

- In classes Theoretical/Practical resolution of mathematical problems. Class discussion of the results and their interpretation.
- The practical classes using the software Matlab/Simulink allow the simulation of the main types of drives.
- In contact with laboratory equipment and test drives.

9. Bibliography

- João Palma, "*Accionamentos Electromecânicos de Velocidade Variável*", Fundação Calouste Gulbenkian, ISBN 972-31-0839-9, 1999;
- Elmano Margato, Miguel Chaves, Paulo Gambôa, "*Guias dos Trabalhos Laboratoriais*";
- Miguel Chaves, Paulo Gambôa, "*Accionamentos Electromecânicos de Velocidade Variável*", Textos de apoio;
- Werner Leonhard, "*Control of Electrical Drives*", Springer, ISBN 978-3-540-41820-7, 2001;
- Bimal K. Bose, "*Modern Power Electronics and Drives*", Prentice Hall, ISBN 978-0130167439, 2001;
- Paul Krause, Oleg Wasynczuk, Scott Sudhoff, Steven Pekarek, "*Analysis of Electric Machinery and Drive Systems*", ISBN:9781118024294, 2013;
- Hakan Gurocak, "*Industrial Motion Control: Motor Selection, Drives, Controller Tuning, Applications*", ISBN: 978-1-118-35081-2, 2015;
- Muhammad H. Rashid, "*Power Electronics Handbook (Fourth Edition)*", Elsevier Inc., ISBN: 978-0-12-811407-0, 2018.