Curricular Unit Sheet

1. Curricular Unit Syllabus.

1.1. Curricular Unit

Regulation and Command Electronics

1.2. Scientific area acronym

EE

1.3. Duration

1 semester

1.4. Total of Working Hours

162h

1.5. Contact hours

T:22,5 TP: 22,5 PL:22,5

1.6. ECTS

6

1.7. Observations

Campo alfanumérico (1.000 carateres).

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

Luís Manuel dos Santos Redondo	3h

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

Hiren Canacsinh	1.5h

4. Learning outcomes of the curricular unit

- Design control and protection circuits for power semiconductors in power converters
- Design circuits for the generation of trigger signals for power semiconductors in power converters
- Design power semiconductors in series and in parallel
- Design power converters and calculate their energy efficiency
- Determine reliability and service continuity in power converters

5. Syllabus

- Power semiconductor devices (PIN, SCR, GTP, IGCT, BJT, MOSFET, IGBT, SIT, SITh, MCT diodes): structure, static characterization, dynamics, overcurrent and overcurrent protection circuits and switching support.
- Differences in Si technology with SiC
- Design of heatsinks.
- Associations of SP in series and in parallel.
- Modeling of modulators (ramp, arcsine, PWM) to generate the control signals of the integrated power semiconductors in power converters. Commercial drivers.
- Design the power semiconductors for a given power converter
- Determine the electrical efficiency of a converter considering the power semiconductors
- Based on the different operating modes of a power converter, determine the redundancy of operation, reliability and service continuity

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

Considering that the main skills acquired in this course are the ability to design power semiconductor control and protection circuits, as well as designing power semiconductors in power converters and determining the energy efficiency of these converters, it is necessary to study the technology, the operation and characteristics of the power semiconductors, their triggering and protection, as well as the serial and parallel association of these. The design of the power semiconductors used in power converters as well as the calculation of the efficiency of these systems is fundamental.

7. Teaching methodologies (including evaluation)

In the theoretical classes the contents are taught and practical cases are presented. In the theoretical-practical classes are carried out application exercises with great intervention of the students. In the laboratory classes are applied the skills acquired with the accomplishment of practical work in group. The evaluation consists in the accomplishment of two mini-tests on theoretical concepts, 20%; in the presentation of reports on laboratory work and discussion thereof, 30%; and in the accomplishment of theoretical exam with exercises of application, 50%.

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

The main competences acquired in this curricular unit are the ability to design control circuits and protection of semiconductor power, as well as dimensioning power semiconductors in power converters and determining the energy efficiency of these converters, being necessary to present the theoretical concepts, perform exercises of application and promote laboratory work to obtain it. The theoretical classes present the fundamental characteristics, technology and operation of power semiconductors, control and protection circuits, and calculation of converter efficiency. For the student to perceive his / her state of learning two mini-tests are carried out, each one being worth 10% of the final grade, without minimum grade.
In the theoretical-practical classes students are offered exercises in the application and simulation techniques of the models and circuits studied. The laboratory classes accompany the theoretical program, thus allowing the student to complement the knowledge acquired. Exercises are carried out, as well as application works: 1) Thyristor trip with transformer coupling; 2) Trip of power semiconductors controlled by PWM signals. In the laboratory component is evaluated the sizing of the works presented for the accomplishment of the same, the reports and discussion of the works. The evaluation has a weight of 30% and a minimum grade of 10 points. At the end there is an exam that is worth 50% of the grade, the final final grade is 10 points. Final Score = 2 × 10% + 30% + 50%

9. Bibliography

- Buhler; “Electronique de Réglage et de Comande”; Dunod, 1983
- Palma; “Circuitos de Comando de Conversores Estáticos de Potência de Comutação Natural”; LNEC; relat. 131/1985
- José Fernando Alves da Silva, “Electrónica Industrial”, Fundação Calouste Gulbenkian, 1999
- Ned Mohan, Tore M. Undeland, William P. Robbins, ” Power Electronics: Converters, Applications, and Design”, John Wiley & Sons, Edição: 4 (21 de agosto de 2017)