Curricular Unit Sheet

1. Curricular Unit Syllabus.

1.1. Curricular Unit

Fundamentals of Pulsed Power, FPP

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

- Understand the difference between how energy is deliver from pulsed power and other traditional forms in direct or alternating current.
- Design high-voltage pulse generation circuits, based on energy storage in capacitors and coils, with power semiconductors
- Know the requirements imposed by the different applications on the generated pulsed, considering types of resistive, capacitive and inductive load

5. Syllabus

- History and concept of Pulsed Power science and technology.
- Characterization of a pulse generation circuit. Generation of pulses based on capacitive and inductive energy storage.
- Generation of pulses based on dc-dc converters, transformers, transmission lines and voltage multiplier circuits. Marx's generator and inductive multiplier.
- Semiconductor based switches for pulse generation. Generation of pulses with microsecond and nanosecond widths.
- Pulsed Power applications, requirements imposed by loads on pulse generators.

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

Considering that the main skills acquired in this course unit are the ability to design circuits to generate high voltage pulses considering different types of load, depending on the application, it is necessary to study the technology, the operation and characteristics of the various techniques for high pulse generation as well as the different industrial applications in the areas of environment, health, food and materials. Knowing how to distinguish methods based on energy storage in capacitors or coils is crucial.

7. Teaching methodologies (including evaluation)

In the theoretical classes are taught the programmatic contents, being presented practical cases. 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 individual works, T1 and T2, and their discussion (where each work is worth 25% of the grade and the minimum grade is 10 points), and a final exam, with a mark of 10 or more, which is worth 50% of the note. (Mean final grade = T1 * 0.25% + T2 * 0.25% + Exam * 0.5%)

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

The main competences acquired in this course unit are the ability to design circuits to generate high voltage pulses considering different types of load, depending on the application, it is necessary to study the technology, the operation and characteristics of the various techniques for generating high voltage pulses well such as the different industrial applications in the areas of environment, health, food and materials. The theoretical classes present the fundamental characteristics, technology and operation of the various methods to generate high voltage pulses, as well as the characteristics of different types of applications in the areas of environment, health, food and materials engineering. Two works are carried out, with theoretical and experimental component, one about the technology and another about the applications. In the execution of the works, a study visit is also carried out, to a company that works in this area, to see industrial implementations of technologies and applications. Each work is worth 25% of the final grade, with a minimum grade of 10 each. In the theoretical-practical classes students are offered exercises in application and simulation techniques of the 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) Generator of Marx, T1; 2) Applications of Electric Fields Pulsed in the feed, T2. 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 practical assessment has a weight of 50% 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 = T1 × 25% + T2 * 25% + Exam 50%

9. Bibliography

- Solid State Pulsed Power Electronics
  Luis Redondo, Fernando A. Silva, in Muhammad Rashid et al, editors: Power Electronics Handbook 3ed, 2010, Butterworth-Hinemann Publishing, Elsevier, ISBN # 9780123820365, chapter 26, pp 669-710.
- Foundations of Pulsed Power Technology,
  Jane Lehr, Pralhad Ron
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