Universidad Zaragoza

Academic Year/course: 2022/23

67241 - Magnetic design for electronic systems

Syllabus Information

Academic Year: 2022/23
Subject: 67241 - Magnetic design for electronic systems
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 622 - Master's in Electronic Engineering
ECTS: 6.0
Year: 1
Semester: First semester
Subject Type: Optional
Module:

1. General information

1.1. Aims of the course

The course is focused to provide Master?s level training in magnetic design for electronic systems. The design of the proposed course includes lectures, laboratory sessions, and a wireless inductive power transfer (IPT) project as a representative application of electronic energy conversion. Topics include a review of electromagnetism principles, magnetic materials, loss mechanisms, and the design of inductors, transformers, and IPT systems.

1.2. Context and importance of this course in the degree

Electronic Engineering is a key enabling discipline which is involved in main research and development fields of current societies. Magnetic components are in the heart of many fields of many applications as power converters or wireless power transfer systems. Societal needs (such as those demanded by the current industry, the research sphere, or academia) are addressed through a focus on topic selection, acquisition of specific skills, and developing representative applications pertaining to the electronic energy conversion field.

1.3. Recommendations to take this course

It is required previous background in electromagnetics, circuit theory and thermodynamics.

2. Learning goals

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The final grade of this course is based on the following items:

- Final exam consisting of multiple-choice questions: 40 % of the grade (CT mark)
- Assignments associated to laboratories: 30 % (CL mark)
- Assignment associated to a final project: 30 % (CP mark)

The final mark (CG) is obtained using the following equations:

- CGaux = 0.4xCL + 0.3xCT + 0.3xCP
- CG = CGaux if (CT, CL, and CP >=3), otherwise CG=min{4, Cgaux}

A final mark greater than or equal to 5 is required to pass the course.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. It is based on participation and the active role of the student favors the development of communication and decision-making skills. A wide range of teaching and learning tasks are implemented, such as:

- Lectures in which the basics of the course are presented.
- Practice sessions in which some representative cases or problems are proposed to students.
- Lab work includes both laboratory experiments and finite-element simulations.

Students are expected to participate actively in the class throughout the semester.

Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other course-specific learning materials.

Further information regarding the course will be provided on the first day of class.

4.2. Learning tasks

The course includes the following learning tasks:

- A01 **Lectures** (30 hours). Lectures are intended to present the basics of the course. Notes and other materials are available on Moodle, the virtual platform of the University.
- A02 **Problem solving sessions** (6 hours). Some selected problems are proposed to students and the solution of these problems is developed in classroom sessions. Notes and other materials are also available on Moodle.
- A03 **Laboratory sessions** (18 hours). Practical activities are intended to reinforce the previously acquired knowledge. These activities include simulation sessions, experiments and prototype development. Instructions, notes and other materials are also available on Moodle.
- A08 **Assessment activities** (estimated 6 hours). The course is assessed by means off the activities included in the Section III of this document.
- A06 **Course assignments and tutorials** (estimated 30 hours). Preparation of the lab session reports and the final project report. Reports will be made in small groups (2 or three people).
- A07 **Study** (estimated 60 hours). Study time is oriented to prepare the exam, problems and lab sessions.

4.3. Syllabus

The course will address the following topics:

Theory

- Topic 1. Basics and magnetic components in power electronic applications.
- Topic 2. Power dissipation in magnetics for power electronic applications.
- Topic 3. Inductive power transfer systems
- Topic 4. Analysis and design of transformers.
- Topic 5. Analysis and design of inductances.

Lab sessions

- P1. Power dissipation in magnetics.
- P2. Finite element simulation of inductive power transfer systems.
- P3. Experimental characterization of inductive power transfer systems.
- P4. Design of a power transfer system application.
- P5. Design of the transformer for a high-voltage power supply.
- P6. Prototyping and testing of the transformer for a high-voltage power supply.

4.4. Course planning and calendar

Lectures and practice sessions run for 2 weekly hours. Laboratory sessions will take place every 2 weeks (6 sessions in total) and last 3 hours each.

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website (https://eina.unizar.es).

4.5. Bibliography and recommended resources

Bibliography and recommended resources are in the following URL link:

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=67241&Identificador=C71987