UAB
Universitat Autònoma de Barcelona

Electronic Power Circuits

Code: 102731
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500895 Electronic Engineering for Telecommunication	OB	3

Contact

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Teachers

David Flores Gual

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Students who register for the subject should have met the following requirements:

1. Mathematical treatment of sinusoidal, triangular and square wave signals (including Fourier decomposition).

2. Know and correctly apply the Kirchoff laws of electrical circuit analysis.

3. Basic notions of energy transmission in AC and DC mode.

4. Basic knowledge of the physics of semiconductors. Diodes and transistors MOSFET

5. Interest in electricity and its management. 6. Fundamentals of magnetism

Objectives and Contextualisation

The objectives of the subject are the following:

1. Understand the methodology of power circuit analysis based on the identification of the current in each component at each instant of time.

2. Know the basic characteristics of the two modes of transport of electric

energy: AC and DC.

3. Achieve minimum competence in the analysis of the flow of electrical

energy in a power system.

4. Know the mode of operation of the different semiconductor power

devices: MOS transistors, diodes, BJTs, thyristors and IGBTs.

5. Learn the static and dynamic characteristics of each of the power

semiconductor devices and be able to select the appropriate component in each application.

6. Understand the electrical and technological characteristics of passive

(resistors, capacitors and coils) and know their function in a power circuit.

7. Analyze the basic topologies of AC / DC and DC / DC converters.
8. Know the operation and utility of the transformers.
9. Achieve minimum skills in heat treatment circuits and power system.

Competences

- Communication
- Design components and electronic circuits in accordance with specifications
- Develop personal attitude.
- Develop personal work habits.
- Develop thinking habits.
- Systematically focus the design of electronic applications and products.

Learning Outcomes

1. Adapt to unforeseen situations.
2. Communicate efficiently, orally and in writing, knowledge, results and skills, both professionally and to non-expert audiences.
3. Consider heat dissipation in the design of power converters.
4. Design analogue and digital electronic circuits: filters.
5. Design electrical energy power supply and conversion circuits for telecommunications and computing applications.
6. Design transformers and inductors for energy converters based on simple analytical models.
7. Develop critical thinking and reasoning.
8. Develop curiosity and creativity.
9. Develop scientific thinking.
10. Develop systemic thinking.
11. Develop the capacity for analysis and synthesis.
12. Generate innovative and competitive proposals in professional activity.
13. Maintain a proactive and dynamic attitude with regard to one's own professional career, personal growth and continuing education. Have the will to overcome difficulties.
14. Make one's own decisions.

15. Manage available time and resources. Work in an organised manner.
16. Optimize the final features of the design of a circuit or system by choosing the appropriate technology for implementation.
17. Prevent and solve problems.
18. Work autonomously.
19. Work in complex or uncertain surroundings and with limited resources.

Content

1. Introduction to power systems

2. Rectification AC / DC recharge with diodes

3. Rectification AC / DC with thyristors (phase control)

4. Direct DC / DC conversion with MOS transistors and diodes

5. DC / DC conversion with transformers

6. Power semiconductor devices

7. Design of passive power elements (L, R and C)

8. Thermal management of power systems and aspects related to the encapsulation of passive and active components

9. DC / AC inversion

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Class. Fundamental concepts	45	1.8	3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 16, 17
Resolution of practical cases of power systems	15	0.6	2, 4, 5, 6, 7, 9, 11, 13, 15, 18
Type: Supervised			
Analysis of different power circuits	35	1.4	1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 13, 14, 15, 16, 17, 18, 19
Lab sessions	12	0.48	1, 2, 3, 4, 5, 6, 7, 8, 9, 13, 14, 15, 16, 17, 18, 19
Type: Autonomous			
Semiconductor devices analysis	22	0.88	2, 3, 7, 8, 10, 11, 13, 14, 15, 16, 18

The evaluation of the subject will include:

1. Partial exams (one of rectification and one of conversion and design of inducers)

2. Laboratory practices

3. Individual or small group exercises

Eventually, and depending on the notes given in the three items to evaluate, there may be slight modifications of the weight of each item in the final grade to correct correct possible errors in the difficulty of an exam, etc. It is necessary to pass the 'partial exams. In case of not doing so, a second opportunity will be available at the end of the course.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exams	60	4	0.16	2, 3, 4, 5, 6, 7, 9, 10, 11, 14, 16, 19
Reports of the exercises	15	9	0.36	2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 18
Reports of the lab sessions	25	8	0.32	1, 2, 3, 4, 5, 6, 7, 9, 13, 14, 15, 16, 17, 18, 19

The evaluation of the subject will include:

1. Two partial exams (one to evaluate the rectification contents and the other to evaluate DC/DC converters)

2. Laboratory practices including PSPICE simulation

Eventually, and depending on the grades given in the three items to be evaluated, there may be slight modifications of the weight of each item in the final grade to correct correct possible errors in the difficulty of an exam, etc. It is necessary to pass the partial exam. In case of not doing so, a second opportunity will be available at the end of the course.

Bibliography

1. D.W. Hart. Electrónica de Potencia. Prentince Hall 2001

2. Kassakian et al. Principles of Power ELectronics. Addison-Wesley 1991

3. Mohan et al. Power Electronics: Converters, Application and Design. Wiley 1989

4. J.L. Muñoz-Sáez et al. Sistemas de Alimentación Conmutados. Paraninfo 1996

5. Professor notes

Software

It is mandatory to have one of the available circuit simulators (PSPICE, LTSPICE, etc.).

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	321	Catalan	second semester	afternoon
(PLAB) Practical laboratories	321	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	322	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	323	Catalan	second semester	morning-mixed
(TE) Theory	320	Catalan	second semester	afternoon