Universitat Autònoma de Barcelona

Advanced Communications Circuit Design 2016/2017

Code: 42836
ECTS Credits: 6

Degree	Type	Year	Semester
4313797 Telecommunications Engineering	OB	1	2

Contact

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Use of languages

Principal working language: english (eng)

Teachers

Jordi Bonache Albacete

Prerequisites

Good knowledge on the fundamentals of RF/microwave engineering

Objectives and Contextualisation

The main aim is the design of communication devices, focused on performance improvement, size and cost reduction, on the basis of advanced concepts, such as artificial transmission lines, and electromagnetic bandgaps, among others. It is also the aim of the module to know and use electromagnetic simulators for the design of RF/microwave components, as well as to stablish specific experimetnal set-up for the characterization of RF/microwave components.

Skills

- Capacity for critical reasoning and thought as means for originality in the generation, development and/or application of ideas in a research or professional context.
- Capacity for developing electronic instrumentation as well as transducers, actuators and sensors.
- Capacity to apply advanced photonic and optoelectronic knowledge , as well as high frequency electronics
- Demonstrate an entrepreneurial, creative and innovative spirit
- Possess and understand knowledge that provides a basis or opportunity for originality in the development and/or application of ideas, often in a research context
- Student should possess the learning skills that enable them to continue studying in a way that is largely student led or independent
- Students should know how to apply the knowledge they have acquired and their capacity for problem solving in new or little known fields within wider (or multidisciplinary) contexts related to the area of study
- Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously

Learning outcomes

1. Apply miniaturisation strategies to the design of microwave components.
2. Capacity for critical reasoning and thought as means for originality in the generation, development and/or application of ideas in a research or professional context.
3. Demonstrate an entrepreneurial, creative and innovative spirit
4. Design high performance and low cost communications circuits using periodic structures (electromagnetic and photonic crystals) and artificial transmission lines.
5. Design microwave components using equivalent circuits and simulation tools.
6. Design simple sensors based on RF techniques
7. Develop advanced high frequency components using engineering techniques of dispersion and impedances.
8. Establish size and characterisation environments for communications circuits
9. Possess and understand knowledge that provides a basis or opportunity for originality in the development and/or application of ideas, often in a research context
10. Student should possess the learning skills that enable them to continue studying in a way that is largely student led or independent
11. Students should know how to apply the knowledge they have acquired and their capacity for problem solving in new or little known fields within wider (or multidisciplinary) contexts related to the area of study
12. Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously

Content

- Miniaturization techniques. Slow-wave components, semilumped components.

- Spurious and interference suppression techniques. Periodic structures. Electromagnetic bandgaps.

- Artificial transmission lines. Dispersion and impedance engineering. Applications: broadband and multiband components, filters and diplexers, distributed amplifiers, microwave sensors, leaky wave antennas.

- Electromagnetic software tools.

- Instrumentation and characterization.

Methodology

The methodology will combine in-situ classes, problem resolution, work in the laboratory, the realization of supplemental works from recommended lectures and autonomous work as well. Virtual platforms will be used.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
presential classes	30	1.2	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
problem resolution	15	0.6	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12
Type: Supervised			
work at lab	15	0.6	1, 2, 4, 5, 6, 7, 8, 9, 11, 12
Type: Autonomous			
study by the student and preparation of lab exercises	70	2.8	1, 4, 5, 6, 7, 8

suplementary work	10	0.4	1, 2, 3, 4, 5, 6, 7, 8, 11, 12

Evaluation

Final exam (75%)

Deliverables from lab. and exercises (25%)

Changes to this evaluation method are possible if considered by the Teacher. "No present" applies if the student does not make the exam. Moreover, at least one exam will be done before the final exam.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Exam	75%	10	0.4	1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12
lab	25%	0	0	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

Bibliography

1. F. Martín, Artificial transmission lines for RF and microwave Applications, John Wiley & Sons Inc, New Jersey, 2015.
2. C. Caloz and T. Itoh, Electromagnetic Metamaterials: Transmission Line Theory and Microwave Applications, John Wiley & Sons,INC, New Jersey, 2006.
3. G.V. Eleftheriades and K.G. Balmain, Negative refraction metamaterials: fundamental principles and applications, John Wiley & Sons, Inc, New Jersey 2005.
4. R. Marqués, F. Martín, and M. Sorolla, Metamaterials with negative parameters: theory, design and microwave applications, John Wiley & Sons Inc, New Jersey, 2007.