

Advanced Communications Circuit Design

Code: 42836
ECTS Credits: 6

2025/2026

Degree	Type	Year
Telecommunication Engineering	OB	1

Contact

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Teachers

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Teaching groups languages

You can view this information at the [end](#) of this document.

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 establish specific experimental set-up for the characterization of RF/microwave components.

Competences

- 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.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
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Type: Directed			
presential classes	30	1.2	1, 2, 3, 7, 4, 5, 6, 8, 11, 12, 10, 9
problem resolution	15	0.6	1, 2, 3, 7, 4, 5, 6, 8, 11, 12, 9

Type: Supervised				
work at lab	15	0.6	1, 2, 7, 4, 5, 6, 8, 11, 12, 9	
Type: Autonomous				
study by the student and preparation of lab exercises	70	2.8	1, 7, 4, 5, 6, 8	
supplementary work	10	0.4	1, 2, 3, 7, 4, 5, 6, 8, 11, 12	

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.

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
Exam	75%	10	0.4	1, 2, 7, 4, 5, 6, 8, 11, 12, 10, 9
lab	25%	0	0	1, 2, 3, 7, 4, 5, 6, 8, 11, 12, 10, 9

One or two exams each with a total weight of 75%, or an exam and a report on a scientific paper.

Deliverables from lab. and exercises (25%)

The minimum to overcome the subject in regard to the two exams is an average of 4. If not, it is not possible to overcome the subject with the lab exercices.

if the continuos evaluation is not passed by the student, then there will be a final exam where, again, a minimumn of 4 is needed to overcome the subject. If the score in the final exam is less than 4, then the maximum final score will not be above 4.9.

"No present" applies if the student does not make the exam. I global final score of 5 is needed.

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.

Software

Keysight ADS

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(TEmRD) Teoria (màster RD)	1	English	second semester	afternoon