UAB
Universitat Autònoma de Barcelona

Radiofrequency and Microwave Engineering

Code: 102738
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500895 Electronic Engineering for Telecommunication	OB	3

Contact

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Teachers

Juan Fernando Martin Antolin

Ferran Paredes Marco

Paris Velez Rasero

Teaching groups languages

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

Prerequisites

It is necessary to have succeed in the subject "Radiació i ones guiades"

Objectives and Contextualisation

The objective of the subject is to provide the fundamentals for the analysis and design of communication components and circuits based on distributed parameters, i.e., transmission lines and stubs. To this end, it will be necessary to study the propagation in transmission lines and their fundamental parameters, including also the Smith chart as a tool for the analysis and design of circuits based on distributed parameters. It will be also necessary to study the microwave networks, the scattering matrix and their properties, as well as symmetry properties of microwave networks. The specific aim of the subject is that the student be able to design components and circuits subjected to specifications. Commercial simulation tools available in the laboratory will be used.

Competences

- Communication
- Design components and electronic circuits in accordance with specifications

- Design, analyse and propose specialised radiofrequency and microwave components, devices, circuits and systems for telecommunication systems.
- Develop personal work habits.
- Develop thinking habits.
- Work in a team.

Learning Outcomes

1. Assume and respect the role of the different members of a team, as well as the different levels of dependency in the team.
2. Critically evaluate the work done.
3. Design RF and microwave circuits
4. Determine optimal strategies for the synthesis of communications components and systems on the basis of their needs and specifications.
5. Develop critical thinking and reasoning.
6. Develop independent learning strategies.
7. Develop scientific thinking.
8. Develop systemic thinking.
9. Efficiently use ICT for the communication and transmission of ideas and results.
10. Identify, manage and resolve conflicts.
11. Prevent and solve problems.
12. Select specialized electronic circuits and devices for transmission, routing and terminals in both fixed and mobile environments.
13. Work autonomously.

Content

Transmission lines. Propagation in transmission lines. Complex propagation constant. Characteristic impedance. Impedance of a terminated line. Reflection and transmission coefficient. Voltage standing wave ratio (VSWR). Smith chart. Impedance matching. Dispersion and losses. Types of transmission lines.

Microwave networks. Scattering matrix. Properties of the scattering matrix. Parameters of a two-port network. Transmission matrix. Symmetry properties.

Components and circuits based on distributed parameters:

- Microwave passive components: lumped and semi-lumped components, attenuators, inverters, power dividers, directional couplers, filters.

- Active components and circuits (mixers, amplifiers and oscillators)

Introduction to planar antennas.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Design of RF and microwave components/circuits based on specs	60	2.4	3, 4, 12
Type: Supervised			

Tutorship	40	1.6	3, 4, 12
Type: Autonomous			
Study by the student	50	2	3, 4, 12

Directed activities:

Magister classes

Problems seminar

Lab sessions

Supervised activities: tutorship

Autonomous activities:

Study by the students

Problems solution

Preparation of lab sessions

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
Evaluation of the lab reports	25%	0	0	1, 3, 4, 5, 10, 12
partial and final exams	75%	0	0	2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13

Continuous evaluation of the part "partial and final exams", with at least two partial exams (with a part devoted to problems and a part devoted to theory), will be carried out. If the continuous evaluation is not surpassed, the final exam will be mandatory. At least a score of 4 out of 10 is necessary in the final exam in order to surpass the subject averaging with the lab reports. The average of the partial exams should be at last 4 out of 10 in order to avoid the realization of the final exam. This part has a weight of 75%. The results of the reports of the lab will have a weight of 25%. It is necessary to pass the lab in order to pass the subject.

To recover the activities (if it is necessary), it will be done after the lectures period (this does not apply to lab exercises). The professors have the right to modify the evaluation procedure depending on the specific circumstances that may appear during the training period.

Students that repeat the subject will maintain the score of the lab reports.

Copying or allowing copying will be penalized with a zero score in the corresponding activity.

If the student realizes a partial exam, he/she is evaluated with a score. This subjet does not consider "unique evaluation".

Bibliography

- D.M. Pozar, *Microwave Engineering*, 3rd Edition, John Wiley, 2005.

- I. Bahl, P. Barthia, Microwave Solid State Circuit Design, 2nd Edition, John Wiley, 2003.

- F. Martín, Artificial Transmission Lines for RF/Microwave Applications, John Wiley, 2015.

Software

Keysight ADS

Language list

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