Linear Networks

Code: 42851
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

A background in microwave engineering is recommended.
High level of mathematics is required.

Objectives and Contextualisation

Objectives

The aim of this module is to provide the ability to design components for communications, with particular emphasis on synthesis of linear components, from the mathematical definition of the response to a circuital network, lumped element based, which has the desired response. Different technologies connected to the network synthesis approach will be analyzed. Examples and exercises will be implemented for better understanding of the content.

Competences

- Capacity for working in interdisciplinary teams
- Capacity to design communications components such as routers, commuters, concentrators, emitters and receivers in different bandwidths.

- 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. Capacity for working in interdisciplinary teams
2. Choice of the most appropriate technology for subsequent design in terms of performance and band frequency.
3. Design linear devices at different bandwidth frequencies
4. Student should possess the learning skills that enable them to continue studying in a way that is largely student led or independent
5. 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
6. 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
7. Synthesis devices with linear responses at different bandwidth frequencies

Content

1. Fundamentals of Circuit Theory

2. Characterization of Lossless Lowpass prototype Filter

3. Synthesis of a General Class of Chebyshev Filter.

4. Coupling Matrix

5. Physical realization of a cavity filter.

6. General Extracted Pole

7. Synthesis of Acoustic Wave Filters.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Exercises	7	0.28	
Lab	12	0.48	
Theory classes	26	1.04	
Type: Supervised			

Tutorials	15	0.6
Type: Autonomous		
Lab and exercises preparation	17.5	0.7
Study	65	2.6

The classes will be carried out online.

Content

- Introduction.
- Analysis of multi-port networks. Parameter definitions.
- Mathematical synthesis of the transfer function.
- Network synthesis - Circuit approach.
- Coupling matrix synthesis.
- Reconfiguration techniques.
- Technology and design techniques.

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
Attendance and Participation	10%	0.5	0.02	4
Exam 1	20%	2	0.08	3, 5, 4, 7
Final Exam	40%	2	0.08	3, 2, 5, 6, 4, 7
Lab Sessions	30%	3	0.12	1, 3, 2, 5, 6, 4, 7

Evaluation

Laboratory (30%)

Student's ability to solve practical problems will be assessed taking into account submitted reports, autonomy in problems resolution during lab sessions, ability to work as a team with other students and diligence.

Exam 1 (20%)

MId-course exam to check the propper evolution of the student.

Final Exam (40%)

A final exam will be done at the end of the term including the contents of the subject.

Attendance and Participation (10%)

The attendance to classes and different activities along the course will be a part of the evaluation. Autonomous work and participation in the proposed activities will also determine a part of final marks.

Final grade = Lab*0.3 + Exam1*0.2 + Final Exam*0.4 + Attendance*0.1

In the case that the student does not participate in any of the activities presented above, his qualification will be "No qualification".

For those students not achieving a mark of 5 in the previous activities a recuperation Exam will be carried out with the next average:

NF_rec = 0.3Lab + 0.7Rec_Exam

Bibliography

J. S. Hong, Microstrip Filters for RF/Microwave Applications, 2nd ed., Wiley, 2011.

R. J. Cameron, C. M. Kudsia and R. R. Mansour, Microwave filters for communication systems: fundamentals, design, and applications. Wiley, 2007.

R. E. Collin, Foundations for Microwave Engineering, McGraw-Hill, 1966.

D. M. Pozar, Microwave Engineering, Wiley, 2009.

Software

Matlab

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	first semester	morning-mixed