Course guide
230052 - MICROS - Microwaves

Last modified: 14/06/2023

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.

Degree: BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura

Others: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma

REQUIREMENTS

RADIATION AND PROPAGATION - Precorequisite

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Generical:
2. They will have acquired knowledge related to experiments and laboratory instruments and will be competent in a laboratory environment in the ICC field. They will know how to use the instruments and tools of telecommunications and electronic engineering and how to interpret manuals and specifications. They will be able to evaluate the errors and limitations associated with simulation measures and results.

Transversal:
1. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.

TEACHING METHODOLOGY

Application classes
lectures
laboratory classes
Group work (learning)

LEARNING OBJECTIVES OF THE SUBJECT

Students will learn the basic techniques of analysis and design of microwave circuits and must know the various technologies used in this frequency range .

Learning outcomes :

Analyze the components and specifications for guided and unguided communications systems.

Knows and can select circuits and systems, RF subsystems , microwave, broadcast , link radio and radiodetermination.

Study with books and papers in English and can write a report or technical work in English, and participate in a technical meeting conducted in this language.

Use independently tools , instruments and software applications available in the laboratories of basic and advanced subjects . Learn how it works and its limitations.

Use strategies to write documents with consistent content , structure, style appropriate, good level of spelling and grammar .

Makes tasks based on the guidelines of teachers deciding the time and resources required . Assesses own strengths and weaknesses and act accordingly .
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STUDY LOAD

Type	Hours	Percentage
Self study	85,0	56.67
Hours large group	52,0	34.67
Hours small group	13,0	8.67

Total learning time: 150 h

CONTENTS

(ENG) Tema 1. Introduction and basic concepts

Description:
The transmission line in sinusoidal steady-state

Full-or-part-time: 4h
Theory classes: 2h
Self study : 2h

(ENG) Tema 2. Microwave Networks analysis techniques

Description:
Planar lines (microstrip and stripline)
Amplitude waves. Generalized reflection coefficient
S. Parameters Definition and properties
Biports analysis. Examples
Waveguide discontinuities

Full-or-part-time: 43h
Practical classes: 14h
Laboratory classes: 4h
Self study : 25h

(ENG) Tema 3. Passive Networks

Description:
Networks 3 ports splitters and circulators
Networking 4-ports hybrids and couplers
PIN diodes: switches, attenuators, modulators and phase shifters
Schottky diodes: detectors and mixers
Microwave Filters

Full-or-part-time: 72h
Theory classes: 24h
Laboratory classes: 6h
Self study : 42h

(ENG) Tema 4. Active Networks

Description:
Microwave amplifiers
Microwave oscillators

Full-or-part-time: 25h
Theory classes: 8h
Laboratory classes: 2h
Self study : 15h

ACTIVITIES

(ENG) Short answer exams (Test)

Description:
2 exams

Full-or-part-time: 2h
Theory classes: 2h

(ENG) Exercises

Description:
Previous study of the practices and final report

Full-or-part-time: 6h
Self study: 6h

pRACTICE 1:TRANSMISION LINES AND IMPEDANCE MATCHING

Description:
Review the basics of transmission lines (TL).
Using the Smith chart representation and calculation of reflection coefficients and impedances in LT.
LT microstrip design.
Introduction to the ADS program and use the program to calculate the reflection coefficients and adaptive network based on LT microstrip.

Full-or-part-time: 2h
Laboratory classes: 2h

PRACTICE 2: BIPORTS STUDY

Description:
Inverter design and comparison of its parameters [S] simulated with an ideal inversor.
Design of a symmetrical attenuator.
Verifying matching network Practice 1 (simultaneous input and output conjugate match).
Measure an attenuator with the network analyzer

Full-or-part-time: 2h
Laboratory classes: 2h

PRACTICE 3: STUDY OF 3 PORTS DEVICES (dividers / combiners)

Description:
Simulation of S parameters as a function of frequency.
Comparison of a Wilkinson divider with another divider with no isolated outputs.
Measurement of S parameters of a divider with Network Analyzer.

Full-or-part-time: 2h
Laboratory classes: 2h

PRACTICE 4: STUDY OF 4 PORTS DEVICES (HYBRID)

Description:
Design of a 90 ° hybrid of ideal transmission lines.
S parameters simulation of the ideal hybrid as a frequency function.
Obtaining the layout of a 90 ° hybrid designed with microstrip lines.
Making hybrid microstrip 90 º and measurement with Network Analyzer

Full-or-part-time: 2h
Laboratory classes: 2h

PRACTICE 5: FILTERS

Description:
Design a bandpass filter with coupled lines.
Simulation of the filter based on the frequency.
Obtaining the layout of the filter made ??with coupled microstrip lines.
Making filter, and measurement by the network analyzer.

Full-or-part-time: 2h
Laboratory classes: 2h

PRACTICE 6: AMPLIFIERS

Description:
Unilateral amplifier design
Amplifier simulation as a frequency function.
Comparison of simulated and specified characteristics.
Verification of the stability of the amplifier

Full-or-part-time: 2h
Laboratory classes: 2h

Final exam with long answers

Description:
Final exam

Full-or-part-time: 3h
Theory classes: 3h

GRADING SYSTEM

Final exam: 60%
Two control tests during the year: 10% and 10%
Laboratory work 15%
Proposed problems: 5%

This course will assess generic skills:
- Effective oral and written (Middle Level)
- Experimentation and knowledge of tools and instruments (High Level)

BIBLIOGRAPHY

Basic:
- Pozar, D.M. Microwave engineering [on line]. 4th ed. Hoboken: Wiley, 2012 [Consultation: 09/04/2021]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=2064708. ISBN 9780470631553.

RESOURCES

Audiovisual material:
- Nom recurs. Resource