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230052 - MICROS - Microwaves

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 739 - TSC - Department of Signal Theory and Communications

Academic year: 2019

Degree: BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Optional)

ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: Nuria Duffo Ubeda

Others: Lluís Pradell
Adolf Comeron

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

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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 .
Use strategies to texts and documents with consistent content , structure and style appropriate level and good 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 .

Study load

Total learning time: 150h	Hours large group:	52h	34.67%
	Hours small group:	13h	8.67%
	Self study:	85h	56.67%

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Content

(ENG) Tema 1. Introduction and basic concepts

Learning time: 4h
Theory classes: 2h
Self study : 2h

Description:
The transmission line in sinusoidal steady-state

(ENG) Tema 2. Microwave Networks analysis techniques

Learning time: 43h
Practical classes: 14h
Laboratory classes: 4h
Self study : 25h

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

(ENG) Tema 3. Passive Networks

Learning time: 72h
Theory classes: 24h
Laboratory classes: 6h
Self study : 42h

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

(ENG) Tema 4. Active Networks

Learning time: 25h
Theory classes: 8h
Laboratory classes: 2h
Self study : 15h

Description:
Microwave amplifiers
Microwave oscillators

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Planning of activities

(ENG) Short answer exams (Test)	Hours: 2h Theory classes: 2h
Description: 2 exams	

(ENG) Exercises	Hours: 6h Self study: 6h
Description: Previous study of the practices and final report	

pRACTICE 1:TRANSMISION LINES AND IMPEDANCE MATCHING	Hours: 2h Laboratory classes: 2h
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.	

PRACTICE 2: BIPORTS STUDY	Hours: 2h Laboratory classes: 2h
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	

PRACTICE 3: STUDY OF 3 PORTS DEVICES (dividers / combiners)	Hours: 2h Laboratory classes: 2h
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.	

PRACTICE 4: STUDY OF 4 PORTS DEVICES (HYBRID)	Hours: 2h Laboratory classes: 2h

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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

PRACTICE 5: FILTERS	Hours: 2h Laboratory classes: 2h

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.

PRACTICE 6: AMPLIFIERS	Hours: 2h Laboratory classes: 2h

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

Final exam with long answers	Hours: 3h Theory classes: 3h

Description:
Final exam

Qualification 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)

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Bibliography

Basic:

Pozar, D.M. Microwave engineering. 4th ed. Hoboken: Wiley, 2012. ISBN 9780470631553.