SUBJECT TEACHING GUIDE

G1486 - High Frequency Electronics

Degree in Telecommunication Technologies Engineering

Academic year 2026 - 2027

1. IDENTIFYING DATA					
Degree	Degree in Telecommunication Technologies Engineering			Type and Year	Optional. Year 4
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Speciality Optional Subjects				
Course unit title and code	G1486 - High Frequency Electronics				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Web	https://web.unican.es/centros/etsiit/estudios/detalle-asignatura?c=G1486&pi=99&a=2023				
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIA DE COMUNICACIONES
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Other lecturers	JUAN PABLO PASCUAL GUTIERREZ ENRIQUE VILLA BENITO

3.1 LEARNING OUTCOMES

Applying strategies for the resolution of technical problems, specific to this profession:
1.- Team-work cooperative capability.
2.- Student response to real-life problems, typical of the work in the radiocommunications industry.
3.- Distinction of the peculiarities of RF and microwave electronic circuits when compared to conventional DC and low-frequency electrical and electronic circuits.
4. Becoming familiar with the basic elements in the architecture of wireless systems.
5. Specification and appropriate characterization of their building blocks.
6. Exploiting the properties of high-frequency active devices in the optimization of different circuit applications.
7. Getting knowledge of high frequency measurement techniques.
8. Development of design and implementation skills according to the needs of the industry.

4. OBJECTIVES

Introduction to the basic parameters and more frequent formalisms required to characterize high-frequency electronic systems and subsystems.
Presentation of the most typical architectures for a radiofrequency system.
Detailed analysis of each of its components: oscillators-synthesizers, mixers, low-noise and power amplifiers.
Description of subsystem operating principles as well as of the conventional technologies for their implementation.
Evaluation of their performance by appropriate figures of merit and measurement techniques.
Development of strategies and design procedures, together with practical criteria for laboratory implementation and adjustment.

6. COURSE ORGANIZATION

CONTENTS	
1	Introduction: High-frequency principles. Distributed electronic systems. Smith chart. S parameters. Small-signal and low-noise RF amplifiers.
2	Oscillators: RF oscillators: VCO's, Phase Locked Loops (PLL), synthesizers, phase noise.
3	High-frequency power amplifiers: Introduction, power amplifier as energy transducer, amplifying devices, figures of merit and measurement techniques, general scheme, operating modes, current-source controlled operating classes.
4	Mixers: Introduction, figures of merit and characterization techniques, mixing devices, diode and field effect transistor mixer fundamentals.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessment	%
Evaluation exercises or continuous monitoring	Others	No	Yes	80,00
Lab practices	Laboratory evaluation	No	No	20,00
Final exam	Written exam	Yes	Yes	0,00
TOTAL				100,00

Observations

Continuous Assessment (learning activities):

This subject is divided into two blocks or parts, corresponding to topics 1 and 2 on the one hand, as well as 3 and 4 on the other.

Evaluation or monitoring exercises: They will be made throughout the course, up to a maximum of four, one for each topic. These exercises will combine the performance of practical work, and/or simulation, and/or design, and/or laboratory characterization activities with written tests. Students could be also required to complete oral presentations on selected topics. Its weight in the total score of the continuous evaluation will be 80%, in case of being approved, or 40% if not (unless it is waived).

Laboratory practices: They will be evaluated with a rating for each theme. Its weight in the total score of the continuous evaluation will be 20%.

The total score of continuous assessment will be obtained from the average of the conducted monitoring exercises and practices, resulting in a 100% if they are approved (80% exercises + 20% practices), 60% (40% exercises + 20% practices) if not, or 20% (practices) in case of waiving the qualification obtained in such exercises.

Final exam:

At the end of the course, on the date set by the School, a written examination including theoretical and practical topics will be held.

The student who may have approved the course by the continuous evaluation process will not have to take the final exam (to pass this continuous evaluation, it may be required to have obtained a minimum grade of 5.00 points in each of the parts of the subject). The qualification will be the total of the continuous assessment (80% exercises plus 20% practices), except those wishing to improve their marks and explicitly renouncing to the one received by the continuous evaluation process for each particular topic.

For students who may have not passed the monitoring exercises, the weight of the final exam in the final grade will be of 40%. If renouncing to the grade obtained in the monitoring exercises, it will then be of 80%. The students, who may have passed some topics in the continuous evaluation process, will not need to complete the corresponding problems in the final exam.
Observations for part-time students
Students who may have not followed the continuous assessment must complete and submit the practices, besides passing the final exam. The weight of this examination will be 80% of the total mark, with the remaining 20% for the practices.

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
"Microwave Transistor Amplifiers: Analysis and Design (2nd Edition)", Guillermo Gonzalez. Prentice Hall, 1996.
"Microwave Devices, Circuits and Systems for Communicaions Engineering", Ed. I.G. Glover, S.R. Pennock y P.R. Shepherd, Wiley, 2005.
"RF Power Amplifiers" 2nd Edition, Marian K. Kazimierczuk, Wiley 2015.
"Microwave Mixers", Stephen A. Maas, 2nd Ed., Artech House, 1993.
"The RF and Microwave Circuit Design Cookbook", S. A. Maas, Artech House, 1998.