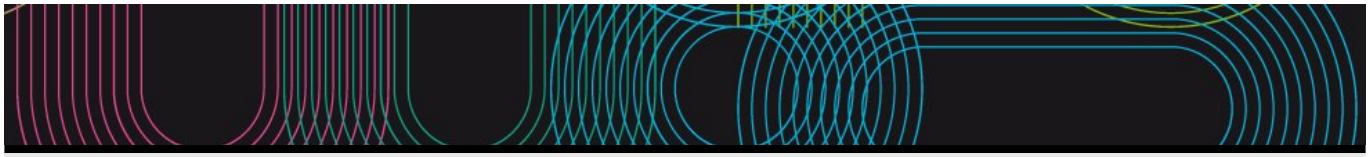

IDENTIFYING DATA				
Electronics and Photonics for Communications				
Subject	Electronics and Photonics for Communications			
Code	V05M145V01202			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Mandatory	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Fernández Barciela, Mónica			
Lecturers	Fernández Barciela, Mónica Fraile Peláez, Francisco Javier Isasi de Vicente, Fernando Guillermo			
E-mail	monica.barciela@uvigo.es			
Web	http://faitic.uvigo.es			
General description	The aim of the subject is that the student adquires knowledge on the actual implementation of transceivers for the modern communication systems that transmit in the radiofrequency and optical bands bands. In the case of RF and MW transceivers, the student will learn to evaluate performance, select and design components and analog circuits (active and passive) for them. As an learning aid, the student will use commercial circuit simulators. In the field of the optical communications, the student will learn the operation of the basic transmission and reception components and active optoelectronical subsystems , and will be able to characterise them and select them as function of the optical system to be designed. In this course the student will handle technical and scientific bibliography in English language.			

Competencies	
Code	
B1	CG1 Ability to project, calculate and design products, processes and facilities in telecommunication engineering areas.
B4	CG4 Capacity for mathematical modeling, calculation and simulation in technological centers and engineering companies, particularly in research, development and innovation tasks in all areas related to Telecommunication Engineering and associated multidisciplinary fields.
C2	CE2 Ability to develop radio communication systems: antenna, equipment and subsystems design; channel modeling; link budgeting; and planning.
C3	CE3 Ability to implement systems by cable, line, satellite, in fixed and mobile communication environments.
C12	CE12 Ability to use programmable logic devices, as well as to design advanced electronic systems, both analog and digital. The ability to design communications components such as routers, switches, hubs, transmitters and receivers in different bands.
C13	CE13 Ability to apply advanced knowledge of photonics, optoelectronics and high-frequency electronics.

Learning outcomes	
Expected results from this subject	Training and Learning Results
Learn to evaluate preformance, select and design components and analog subsystems (active and passive) for communication transceptors in diferent frequency bands (radiofrequency, microwaves). As learning aid, the student will use circuit simulators.	B1 B4 C2 C3 C12 C13

Learn the operation of the components and basic transmission and reception active optoelectronical subsystems in optical communications and photonic processing, and being able to characterise them and select them as function of the optical system to design.	B1 B4 C2 C3 C13
Handle technical documentation and scientific bibliography in English	C13

Contents	
Topic	
1. Introduction to circuit design for RF and Microwave transceptors	a. Analog circuits for communication transceptors. b. Transceptor technologies for communication systems transmitting at different frequency bands. Applications. c. Basic concepts. Transmission lines. S parameters. Smith Chart. Impedance matching.
2. Passive circuit design	Couplers, filters and phase shifters.
3. Introduction to microwave linear amplifier design	a. Power and power gain definitions. Gain and noise circles. b. Stability. Stability circles. Bias and stabilization networks.
4. Microwave linear amplifier design	a. Maximum transducer gain design b. Low noise ampliifiiers c. Broadband amplifiers
5. Power amplifier design	a. Loadline and power contours. b. Operating Classes. c. Designing for linearity and efficiency.
6. Frequency converters design	Frequency multipliers and mixers.
7. Signal generators	a. Oscillator design. VCOs b. PLL basics c. PLL based synthesiers. d. Direct digital synthesis.
8. Photonics	a. Semiconductors optical properties. b. Fabry-Perot lasers and DFB. c. Photodetectors. Static and dynamic regime. d. Electro-optic and electro-absorbing modulators.

Planning			
	Class hours	Hours outside the classroom	Total hours
Practice in computer rooms	8	0	8
Master Session	29	72.5	101.5
Short answer tests	1	0	1
Troubleshooting and / or exercises	2	4	6
Practical tests, real task execution and / or simulated.	0	8.5	8.5
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Practice in computer rooms	With the aid of a commercial microwave and RF circuit simulator, the student will analyze various passive (matching networks, filters, couplers, etc.) and active (amplifiers, oscillators) circuits. It will be defined and evaluated different figures of merit and other parameters that will be used for circuits performance evaluation. The work of the student in these practice classes will be evaluated: 1. In continuous evaluation: by answering -in writting form- short questions and performing simple designs during some/one of the practices. 2. In evaluation performed only in a final examination: by means of short questions and circuit designs related with the work performed during the practice in computer rooms. In these practices the student with work towards achieving competencies: CE2, CE3, CE12 y CE13
Master Session	It will take place in a classroom with video projection facilities and blackboard. During these sessions it will be described in detail most of the contents in the subject programme. Competencies under work: CE2, CE3, CE12 y CE13

Personalized attention	
Methodologies	**Description**

Master Session	During the master sessions the lecturer will answer the questions addressed by the students. The students will be also guided by the lecturer during the time assigned for personalized attention in his/her office, in which he/she will resolve their questions related to theoretical and practical work, as well as the design work.
Practice in computer rooms	During the practice in computer rooms the lecturer will answer the questions addressed by the students and guide his/her assigned work.

Assessment

	Description	Qualification	Training and Learning Results
Practice in computer rooms	The work of the student in these practice classes will be evaluated: 1. In continuous evaluation: by answering -in writting form- short questions and performing simple designs during some/one of the practices. 2. In evaluation performed only in a final examination: by means of short questions and circuit designs related with the work performed during the practice in computer rooms.	10	C2 C3 C12 C13
Short answer tests	There will be 2 short examinations, one of them in the same date as the final examination of the students that do not follow continuous evaluation. The two short examinations and the final examination will include both short answer tests and exercises.	30	C2 C3 C12 C13
Troubleshooting and / or exercises	The 2 short examinations, mentioned above, and the Final Exam will include exercises resolution.	40	C2 C3 C12 C13
Practical tests, real task execution and / or simulated.	For students following continous evalutation, it will be mandatory to perform a circuit desing using the circuit simulator, work proposed by the lecturer. This work will be evaluated by a written report and answers to short questions addressed by the lecturer.	20	C2 C3 C12 C13

Other comments on the Evaluation

A) If the student chooses continuous evaluation:

1. It will be compulsory the assistance to the practises in the computer room, as well as the realisation of a design of a microwave circuit by means of the circuit simulator. This design will be proposed by the lecturer and it will be an autonomous work of the student.
The evaluation of the practises will be a 10% of the total subject qualification, and the evaluation of the circuit design will be a 20%. That is to say, the sum of the evaluation of the practical classes and the design will add up to a 30% of the subject qualification.
2. The rest of the subject assessment (up to a 70% of the subject qualification) will be performed by two short exams that will contain exercises resolution, and/or short answers tests. The first short exam will assess up to a 30%, and the second up to a 40%, of the subject qualification. Before performing the second short exam, the student must inform the lecturers about his choice of the method of evaluation.

B) If the student chooses a final exam:

It will only be considered the score he/she obtained in the final examination: in the exercises resolution (in the extensive version) and in the short question test related to: the theoretical part, and the practices in the computer room.
Second Assessment (July):
In July the students who did not pass the subject in May, will be assessed by an similar exam as that described in previous B option. In particular, the students that in May chose continuous evaluation and declare the want to keep the scores obtained in the practises and in the design (that will add up to a 30% of the subject qualification), will perform a reduced version of the final examination described in the previous paragraph (and will add up to a 70% of the subject qualification).

In case of plagiarism detection in any of the student works, the grade obtained by the student in this course will be a failing grade (0) and the course lecturer/s will communicate this issue to the school Board of Directors so they may take those measures deemed appropriate.

Sources of information

Basic Bibliography

D.M. Pozar, **Microwave Engineering**, 3,

Guillermo González, **Microwave Transistor Amplifiers: Analysis and Design**, 2,

Bahaa E. A. Saleh, Malvin Carl Teich, **Fundamentals of Photonics**, 2,

Guillermo González, **Foundations of Oscillator Circuit Design**, 1,

Rhea, Randall W., **HF filter desing and computer simulation**, 1,

Complementary Bibliography

Enrique Sánchez, **Introducción a los dispositivos y circuitos semiconductores de microondas**, 1,

Steve C. Cripps, **RF Power Amplifiers for Wireless Communications**, 1,

Steve C. Cripps, **Advanced Techniques in RF Power Amplifier Design**, 1,

Amnon Yariv, Pochi Yeh, **Photonics Optical Electronics in Modern Communications**, 6,

S. O. Kasap, **Optoelectronics and Photonics: Principles and Practice**, 2,

Egan, William F., **Phase-lock basics**, 1,

Rhea, Randall W., **Discrete oscillator design : linear, nonlinear, transient, and noise domains**, 1,

Recommendations

Subjects that continue the syllabus

Microwave and Millimetre Wave Circuit Design and CAD/V05M145V01317