



## IDENTIFYING DATA

### Radio Frequency Circuits

Subject	Radio Frequency Circuits			
Code	V05G306V01319			
Study programme	Bachelor Degree in Telecommunication Technologies Engineering (BTTE)			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Isasi de Vicente, Fernando Guillermo			
Lecturers	Isasi de Vicente, Fernando Guillermo			
E-mail	fisasi@uvigo.es			
Web	<a href="http://moovi.uvigo.gal/course/view.php?id=286">http://moovi.uvigo.gal/course/view.php?id=286</a>			
General description	Main radio system circuits are studied. In this matter main characteristics and structure are treated. The evaluation of this circuits is studied too. International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

## Training and Learning Results

Code	
B4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
B6	CG6: The aptitude to manage mandatory specifications, procedures and laws.
B8	CG8: To know and apply basic elements of economics and human resources management, project organization and planning, as well as the legislation, regulation and standarization in Telecommunications.
B9	CG9: The ability to work in multidisciplinary groups in a Multilanguage environment and to communicate, in writing and orally, knowledge, procedures, results and ideas related with Telecommunications and Electronics.
C24	CE24/ST4 The ability to select circuits, subsystems and systems of radiofrequency, microwaves, broadcasting, radio link and radio determination.
C25	CE25/ST5 The ability to select transmission antennas, equipment and systems, propagation of guided and non-guided waves, with electromagnetic, radiofrequency and optical media, and their corresponding radio electric spectrum management and frequency designation.
D2	CT2 Understanding Engineering within a framework of sustainable development.
D4	CT4 Encourage cooperative work, and skills like communication, organization, planning and acceptance of responsibility in a multilingual and multidisciplinary work environment, which promotes education for equality, peace and respect for fundamental rights.

## Expected results from this subject

Expected results from this subject	Training and Learning Results	
- Learn to understand the specifications of a subcircuit and the impact these specifications have on the system as a whole. From these specifications, learn how to develop a circuit that complies with them by proposing engineering solutions in which prices, deadlines, availability, etc. are of paramount importance.	B4 B6 B8 B9	C24 C25 D2 D4
- Learn the effect that each parameter of the specifications of a circuit has on the complete system.		
- Learn to analyse the priorities of the parameters as appropriate.		

## Contents

Topic

Main radiocommunication systems characteristics.	Non linear effects
Use of radiofrequency laboratory equipment.	Use and understanding of laboratory equipment: Spectrum analyzer Network analyzer Signal source
Filtros	Theoretical and practical principles of radiofrequency filters.
Study of amplifiers.	Main characteristics Noise in amplifiers
Oscillators	Non linear treatment Oscillators measurement Voltage controlled oscillators (VCO) Phase noise
Frequency synthesizers	Based in PLL. Direct digital synthesis.
Mixers	Basic approach Main mixers structures

### Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	2.5	3.5
Lecturing	17	42.5	59.5
Practices through ICT	2	3	5
Laboratory practical	16.5	33	49.5
Essay	1	1	2
Problem and/or exercise solving	4	24	28
Laboratory practice	0.5	2	2.5

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

### Methodologies

	Description
Introductory activities	Student will be guided to study of previous required knowledge using various sources in order to adequate subject study. Student is encouraged to make use of tutorship hours in order to solve more difficult topics. It is a group activity.
Lecturing	Lecture at classroom using blackboard and computer about subject theory. Through this methodology the competencies B4, B6, B8, B9, C24, C25, D2 and D4 are developed. It is a group activity. International students will be allowed to ask the professor for: a) Information sources and bibliographic references for the study of subject in english. b) have the tutor sessions in english c) tests in english.
Practices through ICT	Learning of some EDA (computer design applications) for design and test of radiocommunication systems. Through this methodology the competencies B4, B6, B8, B9, C24, C25, D2 and D4 are developed. It is a group activity. Software to be used: ADS, Matlab, Python.
Laboratory practical	Radiocommunication systems measurements. Use of radiocommunication circuit measurement equipment. Basic knowledge about radiofrequency circuits manufacturing. Team project using official standards and specifications. Through this methodology the competencies B4, B6, B8, B9, C24, C25, D2 and D4. are developed. It is a group activity.

### Personalized assistance

Methodologies	Description
Laboratory practical	In laboratory practises the professor is pays attention to students' work to solve any question. Moreover, students can make use of tutor sessions at professor's office. Office hours will be scheduled by the professor when a student sends an email asking for it. They will be at the professor's virtual office.
Practices through ICT	In laboratory practises the professor is pays attention to students' work to solve any question. Moreover, students can make use of tutor sessions at professor's office. Office hours will be scheduled by the professor when a student sends an email asking for it. They will be at the professor's virtual office.
Tests	Description
Essay	In addition of master classes, students can make use of tutor sessions at professor's office. Office hours will be scheduled by the professor when a student sends an email asking for it. They will be at the professor's virtual office.

Laboratory practice In doing tests, student's ability must be shown without help.

<b>Assessment</b>				
	Description	Qualification	Training and Learning Results	
Practices through ICT	Tests in order to evaluate the correct comprehension and ability in use of informatic tools.	5	B4 B6 B9	C24 C25
Laboratory practical	Questions of the professor and evaluation on the fly of the work of laboratory. There is the possibility of taking a theoretical exam on the laboratory material, whose value is 30% of this mark.	10	B4 B6	C24 C25
Essay	Project to work into a team. A presentation of the results will be done to professor in which some questions could be asked. The team's member who presents results is chosen by random between all team's members.	20	B4 B6 B8 B9	C24 C25
Problem and/or exercise solving	Written tests of numerical problems. Three continuous assessment (5%, 15%, y 15%) plus one test at the end of course (15%) for students following continuous assessment. In case of online tuition, then the evaluation will be carried out as follows: they will be carried out online including the possibility of a videoconference in which the professor has the possibility of seeing the student and his/her near environment. The test could be as well oral by videoconference.	5 15 15 15	B4 B6	C24 C25
Laboratory practice	Evaluation of practical work. Results of the necessary calculations for the development of the practices.	15	B4 B6 B8 B9	C24 C25 D4

### **Other comments on the Evaluation**

#### **Continuous assessment:**

To pass the subject by continuous assessment it is mandatory to get a 3 points out of 10 in average out of all problems tests. If this condition is not accomplished final mark will be 4 if total average is equal or higher than this mark or the total average in other cases. The schedule of the different tests of continuous assessment will be approved by an Academic Commission of Degree (CAG) and will be available at the beginning of the semester. A student chooses continuous assessment when two or more tests are done. Intermediate tests have not a second opportunity.

When a student doesn't follow continuous assessment or haven't done three or more continuous assessment tests, will do a test (first and second call) at the end of course which will have a value of 50% of the global qualification if student has done lab practises and C group's project. If student has not done such practises and project, has to contact professor for a practical assessment (50%) and a problems test (50%).

To pass the subject it is necessary to get a minimum average mark of 3 out of 10 in problems tests. If this condition is not accomplished final mark will be 4 if total average is equal or higher than this mark or the total average in other cases.

If a student follows continuous assessment, the final mark can not be "not assessed".

Continuous assessment can be waived at any time if an intermediate test is not taken or by informing the teacher before the date of the first opportunity exam.

#### **B groups practices:**

If continuous assessment is chosen laboratory practices are mandatory and the maximum number of absences is 20%. The student can do missing practices agreeing with professor about date and hour to do practices if it is possible.

#### **C groups practices:**

A practical project is proposed to a group of students. This project is de design, construction and test of a practical circuit. This work is evaluated by oral exposition carried by one or more students from the team. These students will be chosen by random way.

#### **Global assessment (ordinary and extraordinary calls):**

Both in final and july examinations if a student has not done B or C practices, the value of them is the same as in continuous assessment (B: 30% and C: 20%). If some of them are missing student can be examined about them in practical way or by

written questions in problem examination. This is a professor's choice.

These practical examinations can be done also by students which want to improve previous marks.

**End of degree assesment:**

The criteria are the same of global assesment.

**English Friendly subject:**

International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.

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**Sources of information**

**Basic Bibliography**

Apuntes de la asignatura, **F. Isasi**, 1,

**Complementary Bibliography**

Electrónica de comunicaciones, **M. Sierra y otros**, 1,

Solid state radio engineering, **Kraus, Bostian y Raab**, 1,

James W. Nilsson, Susan A. Riedel, **Circuitos eléctricos**, 7,

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**Recommendations**

**Subjects that continue the syllabus**

Microwave Circuits/V05G301V01322

Wireless Systems and Networks/V05G301V01326

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**Subjects that it is recommended to have taken before**

Physics: Analysis of Linear Circuits/V05G301V01108

Mathematics: Calculus 1/V05G301V01101

Mathematics: Calculus 2/V05G301V01106

Signal Transmission and Reception Techniques/V05G301V01208

Electronic technology/V05G301V01206

Analogue Electronics/V05G301V01311

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**Other comments**

Students should be skillful in network analysis and know the small signal equivalent circuits.

Electronics subjects around the transistor must be reviewed.

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