ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

593000426 - Signal Processing Techniques For Communications

DEGREE PROGRAMME

59AG - Eit Digital Track On Internet Technology And Architecture

ACADEMIC YEAR & SEMESTER

2020/21 - Semester 2

Index

Learning guide

1. Description

1.1. Subject details

Name of the subject	593000426 - Signal Processing Techniques For Communications
No of credits	5 ECTS
Type	Optional
Academic year ot the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	59AG - Eit Digital Track On Internet Technology And Architecture
Centre	59 - Escuela Tecnica Superior de Ingenieria y Sistemas de Telecomunicacion
Academic year	2020-21

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Juan Anton Moreno Garcia-Loygorri	D8418	juan.moreno.garcia-loygorri@upm.es	M - 08:00 - 08:15
Cesar Benavente Peces	7007	cesar.benavente@upm.es	Sin horario.
Cesar Briso Rodriguez (Subject coordinator)	D8416	cesar.briso@upm.es	M - 12:30 - 14:30 Th - 12:30 - 14:30

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Grado en Ingeniería Electrónica de Comunicaciones ; Grado en Ingeniería de Sistemas de Telecomunicación ;Grado en

4. Skills and learning outcomes *

4.1. Skills to be learned

CB10 - To have the learning abilities to continue studying in a mostly self-guided or autonomous manner

CB6 - To have knowledge that provides the basis or the opportunity of being original to develop and/or to apply ideas, usually in a research context

CE1 - To be capable of analyzing, interpreting and applying standards related to the ICT.

CE7 - To be capable of prposing, organizing and executing research works in the framework of the Information Society engineering..

CESI1 - To be capable of characterizing, designing and deploying wireless communications systems and services

CESI4 - To be capable of developing systems which are based on programmable devices

CGEN3 - To be capable of elaborating, planning strategically, leading, coordinating and managing, both technically and economically, projects in the framework of the Information Society engineering, according to ethical, quality and environmental criteria

CGEN4 - To be capable of planning, calculating and designing systems and services for the Information Society

4.2. Learning outcomes

RA9 - Use propagation models to calculate radio coverage of a transmitter

RA10 - Analyze and characterize mobile communication channels

RA7 - Design wireless communication systems

RA1 - RA9 - Improvement of the public presentation skills of a research work and defense of conclusions

RA19 - Apply new technologies with different systems for solving particular problems in the domain of services and protocols engineering

RA4 - Evaluate communication standards typically used in the deployment of wireless systems

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

Modern communication systems require the use of advanced signal processing techniques for the implementation of functions such as modulation / demodulation, channel compensation, suppression of interferences, etc.

In order to perform these functions, advanced signal processing techniques combined with radio software systems are used to implement these techniques easily.

The subject is focused on the study of the most advanced techniques of signal processing and its application to modern software radio systems. It is based mainly on the use of the MATLAB / SIMULINK program and radio software systems of National Instruments.

5.2. Syllabus

1. INTRODCUTION

2. APLICATION OF MULTIRATE SYSTEMS

3. MIMO SYSTEMS

4. SOFTWARE DESING RADIO

5. CHANNEL EQUALIZATION

6. LABORATORY

6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	**CLASE DE TEORIA** Duration: 02:00			
2	**THEORY** Duration: 02:00	**Practical work 0 : Signal Generation** Duration: 02:00	**THEORY** Duration: 02:00 **THEORY** Duration: 02:00	
3	**Theory** Duration: 02:00	**Practical work 1. Spectrum analysis with FFT.** Duration: 02:00	**THEORY** Duration: 02:00 **Practical work 1. Spectrum analysis with FFT.** Duration: 02:00	
4	**Theory** Duration: 02:00	**Practical work 2. Modulation and demodulation** Duration: 02:00	**THEORY** Duration: 02:00 **Practical work 2. Modulation and demodulation** Duration: 02:00	
5	**Theory** Duration: 02:00	**Laboratory** Duration: 02:00	**THEORY** Duration: 02:00 **Laboratory** Duration: 02:00	**Test** Continuous assessment Presential Duration: 00:30 **Laboratory** Continuous assessment Presential Duration: 00:00
6	**Theory** Duration: 02:00	**Practical work 4. Digital Modulation** Duration: 02:00	**THEORY** Duration: 02:00 **Practical work 4. Digital Modulation** Duration: 02:00	

7	**THEORY** Duration: 02:00	**Practical work 5.** Duration: 02:00	**THEORY** Duration: 02:00 **Practical work 5.** Duration: 02:00	
8	**Theory** Duration: 02:00	**Practical work 6** Duration: 02:00	**THEORY** Duration: 02:00 **Practical work 5.** Duration: 02:00	
9	**Theory** Duration: 02:00	**Practical work 7** Duration: 02:00	**THEORY** Duration: 02:00 **Practical work 7** Duration: 02:00	
10	**Theory** Duration: 02:00	**Practical work 8** Duration: 02:00	**THEORY** Duration: 02:00 **Practical work 8** Duration: 02:00	**Test** Continuous assessment Presential Duration: 00:00 **Laboratory** Continuous assessment Presential Duration: 00:00
11	**Theory** Duration: 02:00	**Practical work 9** Duration: 02:00	**THEORY** Duration: 02:00 **Practical work 9** Duration: 02:00	
12	**Theory** Duration: 02:00	**Practical work 10** Duration: 02:00	**THEORY** Duration: 02:00 **Practical work 10** Duration: 02:00	
13	**Theory** Duration: 02:00	**Practical work 11** Duration: 02:00	**THEORY** Duration: 02:00 **Practical work 11** Duration: 02:00	
14	**Theory** Duration: 02:00		**THEORY** Duration: 02:00	

15	**Theory** Duration: 02:00		**THEORY** Duration: 02:00	
16	**Theory** Duration: 02:00		**THEORY** Duration: 02:00	
17			**Preparatory class for final examination** Duration: 03:00	**Final Examination** Final examination Presential Duration: 02:00

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
5	Test		Face-to-face	00:30	25%	5 / 10	CB10 CE1 CESI4 CGEN3 CE7 CESI1 CGEN4
5	Laboratory		Face-to-face	00:00	25%	5 / 10	CB10 CE1 CESI4 CGEN3 CB6 CE7 CESI1 CGEN4
10	Test		Face-to-face	00:00	25%	5 / 10	CB10 CE1 CESI4 CGEN3 CB6 CE7 CESI1 CGEN4
10	Laboratory		Face-to-face	00:00	25%	5 / 10	CB10 CE1 CESI4 CGEN3 CB6 CE7 CESI1 CGEN4

7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final Examination		Face-to-face	02:00	100%	5 / 10	CB10 CE1 CESI4 CGEN3 CB6 CE7 CESI1 CGEN4

7.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

7.2. Assessment criteria

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Subjet material	Web resource	Notes of the subject. Exercises. Scripts of laboratory practices. Self-assessment questionnaires Links to external resources of interest. Additional documentation

Laboratory	Others	Computers MAtlab software Radio software devices Signal generator

9. Other information

9.1. Other information about the subject

The final focus of the subject is eminently practical. Many practices are carried out based on radio software systems.

TEACHING IN TELE-TEACHING MODE

In case the sanitary conditions do not allow it, the subject may be taught in the Tele-Teaching modality with the following characteristics:

-Theoretical teaching would be taught 100% in the Tele-teaching modality. For this, the MICROSOFT TEAMS platform will be used.

-Labs will be carried out using free software and Mathlab software licensed by the UPM that the student can use. For radio software practices, a Hardawre SDR would be delivered to each student to carry out the practices remotely.

SUSTAINABLE DEVELOPMENT GOALS

The subject is related to the following SDGs:

Goal 4: Education: Training in efficient technologies.

Goal 7: Energy: .

Goal 8: Economic growth..

Goal 9: Infrastructure:

Goal 11: Cities.

Goal 13: Climate change. .