



POLITÉCNICA

INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros de  
Telecomunicacion

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**93000813 - Communications systems workshop**

### DEGREE PROGRAMME

09AQ - Master Universitario en Ingeniería de Telecomunicacion

### ACADEMIC YEAR & SEMESTER

2017/18 - Semester 2

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## 1. Description

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### 1.1. Subject details

<b>Name of the subject</b>	93000813 - Communications systems workshop
<b>No of credits</b>	6 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	Second year
<b>Semester of tuition</b>	Semester 4
<b>Tuition period</b>	February-June
<b>Tuition languages</b>	English
<b>Degree programme</b>	09AQ - Master Universitario en Ingenieria de Telecomunicacion
<b>Centre</b>	Escuela Tecnica Superior de Ingenieros de Telecomunicacion
<b>Academic year</b>	2017-18

## 2. Faculty

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### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
Jesus Grajal De La Fuente (Subject coordinator)	C-407	jesus.grajal@upm.es	M - 10:00 - 12:00
Jaime Esteban Marzo	B-420	jaime.esteban@upm.es	M - 08:00 - 10:00

\* 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

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### 3.1. Recommended (passed) subjects

El plan de estudios Master Universitario en Ingeniería de Telecomunicacion no tiene definidas asignaturas previas recomendadas para esta asignatura.

### 3.2. Other recommended learning outcomes

- Communications, radar, electromagnetics, MATLAB familiarity

## 4. Skills and learning outcomes \*

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### 4.1. Skills to be learned

CE2 - Capacidad para desarrollar sistemas de radiocomunicaciones: diseño de antenas, equipos y subsistemas, modelado de canales, cálculo de enlaces y planificación.

CE3 - Capacidad para implementar sistemas por cable, línea, satélite en entornos de comunicaciones fijas y móviles.

CE5 - Capacidad para diseñar sistemas de radionavegación y de posicionamiento, así como los sistemas radar.

CG2 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio.

CG4 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades.

CT3 - Capacidad para adoptar soluciones creativas que satisfagan adecuadamente las diferentes necesidades planteadas.

CT4 - Capacidad para trabajar de forma efectiva como individuo, organizando y planificando su propio trabajo, de forma independiente o como miembro de un equipo.

## 4.2. Learning outcomes

RA50 - Capacidad de evaluar, diseñar y analizar antenas asociadas a sistemas de comunicaciones o de radiolocalización

RA51 - Conocimiento y caracterización de los elementos de los sistemas de alta frecuencia

RA52 - Capacidad de evaluar, diseñar y analizar los subsistemas de RF asociadas a sistemas de comunicaciones

RA118 - Capacidad de describir un enlace radioeléctrico con arreglo a los parámetros técnicos más relevantes de transmisor y receptor, y de la caracterización de la propagación.

RA23 - Capacidad de abordar la gestión de un proyecto de ingeniería sencillo, en todas sus fases: planificación, asignación de recursos, estudio de la viabilidad económica y seguimiento y control. (CG1, CG2, CT3)

RA169 - Capacidad de abordar un proyecto completo, desde las especificaciones hasta la medida, de sistemas y subsistemas de radiocomunicaciones

RA29 - Habilidad para diseñar y dimensionar un sistema de comunicaciones que integre partes tanto fijas como móviles, de forma práctica, en grupo y con una orientación profesional al trabajo en una empresa

\* 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

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### 5.1. Brief description of the subject

This course is a comprehensive approach to communications and radar systems and the technologies involved. This course is not a design course for active and passive components or circuits. It is a top-down approach that begins with the specifications of a system, goes through the selection of the appropriate technology, components, and circuits to meet these specifications -including design if the market does not offer the required components or subsystems-, and finishes with the fabrication, characterisation, and integration of the different components.

An in-depth understanding of the variety of components in the market and their specifications and limitations are basic for a successful design of increasing complex systems.

Both in-house software developed in Matlab as well as commercial software will be used to analyse and design the different circuits and sub-systems of the proposed communications/radar system.

The system selected for the current academic year (2017-2018) is a CW-LFM (Continuous Wave Linear Frequency Modulated) radar at 2.4 GHz with at least range and Doppler capabilities.

### 5.2. Syllabus

1. Topic 1. CW-LFM Radar at 2.4 GHz. General description
2. Topic 2. Subsystems
  - 2.1. Definition
  - 2.2. Design
  - 2.3. Fabrication
3. Topic 3. Measurements
  - 3.1. Subsystems. Definition, instruments, and realization
  - 3.2. CW-LFM radar. Definition, instruments, and realization
4. Topic 4. Final project documentation and presentation
  - 4.1. Analysis of measurements

## 4.2. Presentation of results

## 6. Schedule

### 6.1. Subject schedule\*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Other face-to-face activities	Assessment activities
1	<b>Topic 1. System description. Design</b> Duration: 02:00 Lecture			
2	<b>Topic 1. System description. Meeting with instructor for clarifying concepts and solving difficulties.</b> Duration: 02:00 Additional activities			
3	<b>Topic 1. Preliminary design. Presentation</b> Duration: 02:00 Cooperative activities  <b>Topic 2.1. Subsystem definition.</b> Duration: 02:00 Lecture			
4	<b>Topic 2.2. Subsystem definition. Meeting with students and groups. Design evaluation.</b> Duration: 02:00 Additional activities			
5	<b>Topic 2.2. Subsystem definition. Meeting with students and groups. Design evaluation.</b> Duration: 02:00 Additional activities			
6	<b>Topic 2.2. Subsystem definition. Meeting with students and groups. Design evaluation.</b> Duration: 02:00 Additional activities			
7	<b>Topic 2.2. Subsystem definition. Meeting with students and groups. Design evaluation.</b> Duration: 02:00 Additional activities			
8		<b>Topic 2.2. Subsystem definition. Meeting with students and groups. Design validation.</b> Duration: 02:00 Additional activities		
9	<b>Topic 3. Measurements: Subsystems.</b> Duration: 02:00 Cooperative activities			



10	<b>Topic 3. Measurements: Radar system.</b> Duration: 02:00 Cooperative activities			
11		<b>Topic 3. System characterization and testing.</b> Duration: 04:00 Laboratory assignments		
12		<b>Topic 3. System characterization and testing.</b> Duration: 04:00 Laboratory assignments		
13		<b>Topic 3. System characterization and testing.</b> Duration: 04:00 Laboratory assignments		
14		<b>Topic 3. System characterization and testing.</b> Duration: 04:00 Laboratory assignments		
15				
16				<b>Evaluation. Individual project presentation.</b> Other assessment Continuous assessment and final examination Duration: 02:00
17				

The independent study hours are training activities during which students should spend time on individual study or individual assignments.

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 subject schedule is based on a previous theoretical planning of the subject plan and might go through experience some unexpected changes along throughout the academic year.

## 7. Activities and assessment criteria

### 7.1. Assessment activities

#### 7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
16	Evaluation. Individual project presentation.	Other assessment	Face-to-face	02:00	100%	5 / 10	CE3 CE2 CT4 CG4 CT3 CG2 CE5

#### 7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
16	Evaluation. Individual project presentation.	Other assessment	Face-to-face	02:00	100%	5 / 10	CE3 CE2 CT4 CG4 CT3 CG2 CE5

#### 7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Evaluation. Individual project presentation.	Other assessment	Face-to-face	02:00	100%	5 / 10	CE3 CE2 CT4 CG4 CT3 CG2 CE5

## 7.2. Assessment criteria

Students will be qualified through continuous evaluation by default. According to the Normativa de Evaluación del Aprendizaje de la Universidad Politécnica de Madrid, students willing to renounce to continuous evaluation must notify in writing, through the Register of the School, to the coordinator before the fourth week of the course.

Evaluation will assess if students have acquired all the competences of the subject. Thus, evaluation through final assessment will be carried out considering all the evaluation techniques used in continuous evaluation (EX, ET, TG, etc.), and will be celebrated in the exam period approved by Junta de Escuela for the current academic semester and year. Evaluation activities that assess learning outcomes that cannot be evaluated through a single exam can be carried out along the semester.

Extraordinary examination will be carried out exclusively by the final assessment method.

In any case (continuous evaluation or final assessment modality), the student will overcome the subject when a grade higher or equal to 50% of the total score is obtained.

Performing all laboratory sessions, as well as obtaining an overall qualification equal or greater to 50% in their evaluation, is required to pass the course in any evaluation modality.

## 8. Teaching resources

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### 8.1. Teaching resources for the subject

Name	Type	Notes
Microwave Laboratory	Equipment	Laboratory for circuit and subsystem characterisation.
Datasheets for devices, circuits and subsystems	Web resource	Datasheets for components that could potentially be used in the design of the radar system.
Bybliography	Bibliography	Bibliography used in the subjects: Antennas (Code: 93000803). Radar Systems (Code: 93000815). High Frequency Circuits (Code: 93000804).