



POLITÉCNICA

INTERNATIONAL
CAMPUS OF
EXCELLENCE

COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingenieros de
Telecomunicación

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

93000928 - Laboratory course on rf measurements

DEGREE PROGRAMME

09AT - Master Universitario En Teoria De La Señal Y Comunicaciones

ACADEMIC YEAR & SEMESTER

2018/19 - Semester 2

Index

Learning guide

1. Description.....	1
2. Faculty.....	1
3. Prior knowledge recommended to take the subject.....	2
4. Skills and learning outcomes	2
5. Brief description of the subject and syllabus.....	4
6. Schedule.....	5
7. Activities and assessment criteria.....	7
8. Teaching resources.....	11

DRAFT VERSION

1. Description

1.1. Subject details

Name of the subject	93000928 - Laboratory course on rf measurements
No of credits	6 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	09AT - Master universitario en teoria de la señal y comunicaciones
Centre	09 - Escuela Tecnica Superior de Ingenieros de Telecomunicacion
Academic year	2018-19

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Manuel Sierra Castañer (Subject coordinator)	C-410	manuel.sierra@upm.es	Sin horario. Please, contact by e-mail
Jesus Grajal De La Fuente	C-407-2	jesus.grajal@upm.es	Sin horario. Please, contact by e-mail

Jaime Esteban Marzo	B-420	jaime.esteban@upm.es	Sin horario. Please, contact by e-mail
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* 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

- Temas avanzados en tecnología de antenas
- Tecnologías de radiofrecuencia

3.2. Other recommended learning outcomes

El plan de estudios Master Universitario en Teoría de la Señal y Comunicaciones no tiene definidos otros conocimientos previos para esta asignatura.

4. Skills and learning outcomes *

4.1. Skills to be learned

CB06 - Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación

CB07 - 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

CB08 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios

CB09 - 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

CB10 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo

CE01 - Analizar y aplicar técnicas para el diseño y desarrollo avanzado de equipos y sistemas, basándose en la teoría de la señal y las comunicaciones, en un entorno internacional

CE02 - Evaluar y sintetizar los resultados de un trabajo en equipo en proyectos relacionados con la teoría de la señal y las comunicaciones, en un entorno internacional.

CE03 - Valorar y contrastar la utilización de las diferentes técnicas disponibles para la resolución de problemas reales dentro del área de teoría de la señal y comunicaciones.

CT01 - Capacidad para comprender los contenidos de clases magistrales, conferencias y seminarios en lengua inglesa

CT03 - Capacidad para adoptar soluciones creativas que satisfagan adecuadamente las diferentes necesidades planteadas

CT04 - Capacidad para trabajar de forma efectiva como individuo, organizando y planificando su propio trabajo, de forma independiente o como miembro de un equipo

CT05 - Capacidad para gestionar la información, identificando las fuentes necesarias, los principales tipos de documentos técnicos y científicos, de una manera adecuada y eficiente

CT06 - Capacidad para emitir juicios sobre implicaciones económicas, administrativas, sociales, éticas y medioambientales ligadas a la aplicación de sus conocimientos

4.2. Learning outcomes

RA9 - To evaluate and to implement RF systems and equipments.

* 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

This laboratory complements the subjects of Radiofrequency Technologies and Advanced Topics on Antenna Technologies. This laboratory introduces the most important measurement techniques in radio-frequency, including active and passive circuits, time and frequency domain measurements, characterization of electrical properties of materials, antenna characterization and RADAR systems.

5.2. Syllabus

1. Session 1: Vector Network Analyzer: Calibration techniques.
2. Session 2: Vector Network Analyzer. Time domain Techniques.
3. Session 3: Active Components Characterization with complex wave forms.
4. Session 4: Antenna Measurements 1. Antenna test set-up. Anechoic Chambers. Far and Near Field Techniques.
5. Session 5: Antenna Measurements 2. Error diagnosis in antenna measurements.
6. Session 6: Characterization of electrical properties of material through free space and waveguide techniques.
7. Session 7: RADAR System characterization.

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	Presentation. Introduction to laboratory sessions 1 and 7 Duration: 04:00 Lecture			
2		Laboratory session 1 Duration: 04:00 Laboratory assignments		
3		Laboratory session 1 Duration: 04:00 Laboratory assignments		Homework/Evaluation Session 1 Individual work Continuous assessment Duration: 00:00
4		Laboratory session 2 Duration: 04:00 Laboratory assignments		Homework/Evaluation Session 2 Individual work Continuous assessment Duration: 00:00
5		Laboratory session 3 Duration: 04:00 Laboratory assignments		Homework/Evaluation Session 3 Individual work Continuous assessment Duration: 00:00
6		Laboratory session 4 Duration: 03:00 Laboratory assignments		Evaluation Session 4 Written test Continuous assessment Duration: 01:00
7		Laboratory session 5 Duration: 04:00 Laboratory assignments		
8		Laboratory session 5 Duration: 04:00 Laboratory assignments		Homework/Evaluation Session 5 Individual work Continuous assessment Duration: 00:00
9		Laboratory session 6 Duration: 04:00 Laboratory assignments		Homework/Evaluation Session 6 Individual work Continuous assessment Duration: 00:00
10			Presentation of RF companies Duration: 04:00 Additional activities	
11		Laboratory session 7 Duration: 04:00 Laboratory assignments		Homework/Evaluation Session 7 Individual work Continuous assessment Duration: 00:00

12		Laboratory sessions 1, 2 and 6: Extra time if required Duration: 04:00 Laboratory assignments		
13		Laboratory sessions 3 and 7. Extra time if required Duration: 04:00 Laboratory assignments		
14		Laboratory sessions 4 and 5: Extra time if required Duration: 04:00 Laboratory assignments		
15				
16				
17				Final exam Problem-solving test Final examination Duration: 04:00

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
3	Homework/Evaluation Session 1	Individual work	No Presential	00:00	14.29%	0 / 10	CB08 CT01 CB07 CT03 CB06 CE02 CT04 CE01 CT06 CE03 CT05 CB10
4	Homework/Evaluation Session 2	Individual work	No Presential	00:00	14.29%	0 / 10	CB08 CT01 CB07 CT03 CB06 CE02 CT04 CE01 CT06 CE03 CT05 CB10
5	Homework/Evaluation Session 3	Individual work	No Presential	00:00	14.29%	0 / 10	CB08 CB09 CT01 CB07 CT03 CB06 CE02 CT04 CE01 CT06 CE03 CT05 CB10

6	Evaluation Session 4	Written test	Face-to-face	01:00	14.29%	0 / 10	CB08 CB09 CT01 CB07 CT03 CB06 CE02 CT04 CE01 CT06 CE03 CT05 CB10
8	Homework/Evaluation Session 5	Individual work	No Presential	00:00	14.28%	0 / 10	CB08 CB09 CT01 CB07 CT03 CB06 CE02 CT04 CE01 CT06 CE03 CT05 CB10
9	Homework/Evaluation Session 6	Individual work	No Presential	00:00	14.28%	0 / 10	CB08 CB09 CT01 CB07 CT03 CB06 CE02 CT04 CE01 CT06 CE03 CT05 CB10
11	Homework/Evaluation Session 7	Individual work	No Presential	00:00	14.28%	0 / 10	CB08 CB09 CT01 CB07 CT03 CB06 CE02 CT04 CE01 CT06 CE03 CT05 CB10

7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final exam	Problem-solving test	Face-to-face	04:00	100%	5 / 10	CB08 CB09 CT01 CB07 CT03 CB06 CE02 CT04 CE01 CT06 CE03 CT05 CB10

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Final Exam	Problem-solving test	Face-to-face	04:00	100%	5 / 10	CB08 CB09 CT01 CB07 CT03 CB06 CE02 CT04 CE01 CT06 CE03 CT05 CB10

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 complete the Moodle task entitled "Renounce to continuous evaluation" before one month before the beginning of the term (deadline will be announced in Moodle).

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 the case of continuous evaluation, the students will be evaluated for each session with the work of each student in the laboratory session and the homework or exam for each session. The final mark will be the average of the mark of the 7 laboratory sessions. It is compulsory to complete all the laboratory sessions to pass the subject.

For the students who choose the final exam (and renounce to the continuous evaluation), an exam will be carried out in one of the laboratories. The exam will be practical, and the student will be required to show his capability to do RF measurements.

The extraordinary exam will be done at the end of June. This exam will be practical, and the student will be required to show his capability to do RF measurements.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Information of each session	Bibliography	Before the sessions, the students will have the required documentation
Laboratories	Equipment	The sessions will be performed in the different laboratories of the Telecom School