

Radiocommunication Systems

Code: 102710
ECTS Credits: 6

Degree	Type	Year	Semester
2500898 Telecommunication Systems Engineering	OB	3	2

Contact

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Use of Languages

Principal working language: spanish (spa)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: Yes

Prerequisites

It is recommended to have successfully taken the courses of Radiation and Guided Waves, Foundations of Communications and Foundations of Networks. This course is closely related to Telecommunications Transmitters and Receivers although it is not a must to take this course previously.

Objectives and Contextualisation

Once completed the course the student should be able to

- Describe the components of a radio communication system
- Obtain the transmission and reception parameters of basic antennas
- Distinguish the basic propagation mechanisms for each frequency band.
- Evaluate the performance of a radio communication link
- Design a radio communication link to meet specifications
- Convey the conclusions of their work in a proper technical language

Competences

- Analyse components and specifications for communication systems that are guided or non-guided by electromagnetic, radiofrequency or optical means.
- Apply the necessary legislation in the exercise of the telecommunications engineer's profession and use the compulsory specifications, regulations and standards.
- Communication
- Develop personal work habits.
- Develop thinking habits.
- Draft, develop and sign projects in the field of telecommunications engineering that, depending on the speciality, are aimed at the conception, development or exploitation of telecommunication and electronic networks, services and applications.
- Learn new methods and technologies, building on basic technological knowledge, to be able to adapt to new situations.
- Select and devise communication circuits, subsystems and systems that are guided or non-guided by electromagnetic, radiofrequency or optical means to fulfil certain specifications.
- Work in a team.

Learning Outcomes

1. Analyse and specify components for guided and non-guided communication systems.
2. Apply design techniques based on radio communication networks, services and applications.
3. Build, exploit and manage radio communication networks, services, processes and applications understood as systems for receiving and transporting.
4. Communicate efficiently, orally and in writing, knowledge, results and skills, both professionally and to non-expert audiences.
5. Describe the principles for the management of the radio-electric spectrum and the allocation of frequencies.
6. Develop independent learning strategies.
7. Develop systemic thinking.
8. Develop the capacity for analysis and synthesis.
9. Select guided and non-guided electromagnetic and radio-frequency antennas, equipment and systems.
10. Select radiofrequency, microwave, broadcasting, radio-link and radio-determination circuits, subsystems and systems.
11. Work cooperatively.

Content

1. Introduction to radio electric systems
2. Elements of a radio system
3. Antenna parameters
4. Link budget for a radio communication system
5. Noise
6. Propagation
7. Fixed terrestrial radio links
8. Satellite radio communication systems
9. Mobile radio communication systems

Methodology

Directed activities

- Lectures: explanation of theoretical contents
- Problem solving: application examples
- Practical work in laboratory: development of a planned activity using simulation tools and/or instrumentation.

Autonomous activities

- Personal study of the course contents
- Solving exercises, preparation of lab activities and reports

Supervised activities

- Tutoring: individual or small group meetings to clarify concepts, to advise on the development of the course or to attend other specific issues.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
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Type: Directed

Lectures	26	1.04	1, 2, 4, 3, 5, 7, 6, 8, 9, 10
Practical work in laboratory	12	0.48	1, 2, 4, 3, 5, 7, 8, 9, 10, 11
Problem solving	12	0.48	1, 2, 4, 3, 5, 7, 6, 8, 9, 10
Type: Supervised			
Tutoring	7	0.28	1, 2, 4, 3, 5, 7, 6, 8, 9, 10
Type: Autonomous			
Personal study	32	1.28	1, 2, 4, 3, 5, 7, 6, 8, 9, 10
Problem solving	24	0.96	1, 2, 4, 3, 5, 7, 6, 8, 9, 10

Assessment

a) Evaluation activities

- Final exam (ExF): 50%. Short questions and problems. It is compulsory to obtain $\text{ExF} \geq 4$ to pass the course.
- Problem solving (EX): 10%. Short questions and problems will be proposed throughout the course.
- Deliverables (EpP): 20%. Solving problems and reading the lab document. All the deliverables have the same weight in EpP.
- Lab reports (InP): 20% Report (per lab group) on the activities developed in the lab. All the reports have the same weight in InP.

Any evaluation activity delivered after the deadline will be qualified with zero.

b) Evaluation activities schedule

- ExF: final exam dates will be public the first day of the course in the Campus Virtual and the web page of the Engineering School.
- EX, EpP and InP: schedule of lab sessions and deliverables will be made public in Campus Virtual.

The schedule can be modified due to unexpected events. Please, check Campus Virtual often since any modification will be published there.

c) Second chance procedure

- ExF: according to UAB regulations there will be one second chance exam for those students with $\text{FEx} < 4$ that have participated in, at least, 2/3 of the evaluation activities of the course.
- EX, EpP and InP: these evaluation activities do not have second chance procedure.

d) Grades revision procedure

For every evaluation activity it will be scheduled a place, date and time for reviewing the grade together with the teacher. The grade of the activity will not be modified after the scheduled date.

e) Final grade

- If $\text{ExF} < 4$, Final grade = ExF
- Si $\text{ExF} \geq 4$, Final grade = $\max(0.5 \cdot \text{ExF} + 0.1 \cdot \text{EX} + 0.2 \cdot \text{EpP} + 0.2 \cdot \text{InP}, 0.8 \cdot \text{ExF} + 0.2 \cdot \text{InP})$
- It is mandatory a final grade ≥ 5 to pass the course
- Matricules d'honor (MH): the highest grade available can only be awarded by the coordinator of the course to those students with the top final grades. According to UAB regulations final grade should be ≥ 9 and the number of MH is restricted to the 5% of the students enrolled in the course.

- "Not evaluated" will be only granted with the student participates in less than 10% of the evaluation activities.

f) Irregularities by the student, copy and plagiarism

Without prejudice to other disciplinary measures considered appropriate, the irregularities committed by the student that can lead to a variation of the grade of an evaluation activity (such as copying plagiarizing, cheating ...) will be qualified with zero.

g) Students repeating the course

There is no differential treatment for students repeating the course. No grades of the previous course will be kept.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Deliverables	20%	15	0.6	1, 4, 5, 7, 6, 8, 9, 10
Final exam	50%	3	0.12	1, 2, 4, 3, 5, 7, 6, 8, 9, 10
Lab reports	20%	15	0.6	1, 5, 7, 8, 9, 10, 11
Problem solving	10%	4	0.16	1, 2, 4, 3, 5, 7, 6, 8, 9, 10

Bibliography

- J.M. Hernando Rábanos, "Transmisión por Radio", Centro de Estudios Ramón Areces, Madrid, 4ª edición, 2003
- Cardama et al., "Antenas" Edicions UPC, Barcelona, 2ª edición, 2002.
<https://upcommons.upc.edu/handle/2099.3/36797>

Software

- FEKO from Altair: electromagnetic solver. <https://altairuniversity.com/feko-student-edition/>
- Radio Mobile: freeware to predict the performance of a radio system.
<http://www.ve2dbe.com/english1.html>