Last update: 09-07-2018

300248 - CA2-MN6 - Aeronautical Communications 2

Coordinating unit: 300 - EETAC - Castelldefels School of Telecommunications and Aerospace Engineering

Teaching unit: 739 - TSC - Department of Signal Theory and Communications

Academic year: 2018

Degree: BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING (Syllabus 2015). (Teaching unit Optional)
BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING/BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2015). (Teaching unit Optional)
BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING/BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2015). (Teaching unit Optional)

ECTS credits: 6 Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: Definit a la infoweb de l'assignatura.

Others: Definit a la infoweb de l'assignatura.

Prior skills

· Operability with complex numbers. Product and sum of complex numbers, rationalization, inversion, calculation of the module and the phase of a complex number.
· Operability both at linear scale as well a in logarithmic scale (dB).
· Operability with trigonometric functions.
· Operability with signals and systems in the frequency domain from the series and the Fourier transform, and apply the main properties of these.
· Knowledge of analog and digital communication systems
· Basic knowledge of antenna parameters

Requirements

Having been enrolled (Pre-requisite) in the course:
· Aeronautical Communications 1

Degree competences to which the subject contributes

Specific:

5. CE 25 AERON. Conocimiento aplicado de: Transmisores y receptores; Líneas de transmisión y sistemas radiantes de señales para la navegación aérea; Sistemas de navegación; Instalaciones eléctricas en el sector tierra y sector aire; Mecánica del Vuelo; Cartografía; Cosmografía; Meteorología; Distribución, gestión y economía del transporte aéreo. (CIN/308/2009, BOE 18.2.2009)

Transversal:

1. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.
3. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
4. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.

Last update: 09-07-2018

300248 - CA2-MN6 - Aeronautical Communications 2

Teaching methodology

Thanks to the material prepared by teachers: slides, lecture notes, solved exercises, etc., available in the digital campus ATENEA, the student has enough tools to work autonomously, either in groups or individually, and thus can use the class time to consolidate concepts and answer doubts.

In the theory sessions (groups with a maximum of 40 students) based on lectures, formal explanation and informal teacher questioning students, who favor the understanding and settlement the basics of the subject, are combined. This active participation by students is possible thanks to the course material that is available, as he has not to be in class just taking notes.

In laboratory sessions (small groups of 20 students maximum) students work in groups of no more than 3, making the proposed measures in the script of the practices, with the assistance of the teacher.
In the problem solving sessions (groups of 20 students maximum) the students work in groups, of at most 3 people, solving exercises related to the theory given in the lectures with the help of the teacher and deepening in a system of aeronautical communications determined with the accomplishment of a work and its exhibition before the rest of the class.

Learning objectives of the subject

Upon completion of the course Aeronautical Communications, the student should be able to:
· Understand the fundamentals and key aspects of the transmission and reception of RF signals
· Know the RF systems used in aeronautical communications
· To study and to calculate the parameters that characterize the signal and guided propagation of electromagnetic waves in transmission lines.
· Understand the main components of a radio communications system.
· Operability with signals in the complex domain
· To study and to calculate the parameters that characterize the signal and free-space propagation of electromagnetic waves.
· Operate on coordinate systems: Euclidean, spherical and cylindrical.
· Understand the operation and properties of different types of antennas that can be used in aeronautical communications.
· Calculate the coverage, capacity and quality of different bonds, fixed and mobile communications employees Aeronautical.
· Describe the different standards and technologies used in the aeronautical communication network in both ground-to-air and ground-ground.

Study load

Total learning time: 150h	Hours large group:	42h	28.00%
	Hours medium group:	12h	8.00%
	Hours small group:	12h	8.00%
	Self study:	84h	56.00%

Last update: 09-07-2018

300248 - CA2-MN6 - Aeronautical Communications 2

Content

AM and FM analog modulations

Learning time: 12h 30m

Practical classes: 4h 30m
Self study : 8h

Description:
In this block we review the analog modulations of amplitude (AM) and frequency (FM), in order that the student is able to generate and measure them in the laboratory.

Related activities:
Activity 1: Laboratory Practices

Guided Propagation, RF Transmission Lines and RF Circuits

Learning time: 35h 30m

Theory classes: 10h
Practical classes: 7h 30m
Self study : 18h

Description:
This block aims to introduce the students to the concept of guided propagation and transmission lines, emphasizing the concept of propagation delay in comparison with low frequency circuits. In the first place we define the concept of transmission line and will describe the main types. Then we resolve the problem of guided propagation in transmission lines presenting the expressions of voltage and current in the transmission line. We introduce the concept of characteristic impedanceof the transmission line. Then we present the parameter of reflection coefficient and the concept of adaptation. Power propagation along the transmission line is presented. We define real transmission lines with losses. In a second part we introduce the student to the tool of the Smith Chart as graphical tool for the study of RF circuits. We introuce the concept of adaptation and the concept of generator available power. The we present the concept of matching network and its realization with lumped elements or distributed elements. Lastly we introduce the students to the concept of RF circuit detailing the main elements of an RF circuit: isolators, amplifiers, filters, mixers, oscillatosr, etc. ..

Related activities:
Activity 1: Problems solving and delivery of the course folder

Antennas

Learning time: 27h

Theory classes: 11h
Self study : 16h

Description:
This block introduces the student to the study and characterization of antennas. After an introduction of the fundamental parameters that characterize an antenna and the transmission equation. Following is the formulation of the electric field radiated by a half wave antenna. Finally, the basic concept of antenna arrays is presented and basic calculations of the array factor are made.

Last update: 09-07-2018

300248 - CA2-MN6 - Aeronautical Communications 2

Radiocommunications Concepts	Learning time: 25h Theory classes: 7h Laboratory classes: 4h Self study : 14h

Description:
This block introduces the students basic concepts of radiocommunications essential for air navigation systems such as: propagation models, coverage and calculations contemplating the effects of the atmosphere and terrain in the received signal, the link budget, the effect of interfering signals, sectorization and frequency allocation, and capacity calculations and link quality as regulation and licensing, for communication, navigation, surveillance and automation systems. Examples of point-to-point and point-multipoint both for terrestrial links and ground-air links and links via satellite will be presented.

Related activities:
Activity 2: In-depth analysis of an aeronautical communication system

Ground-to-air Communications	Learning time: 25h Theory classes: 7h Laboratory classes: 4h Self study : 14h

Description:
In this block the studenr sees the architecture of the ground-to-air communications systems, describing the main characteristics of the control and air traffic management (ATC and ATM), the evolution of the different types of analog and digital links and their performances. Among other studies the HF-VHF analog systems, the VDL or VHF different digital modes, AMSS, SDSL, CPDLC, band reductionrcomparing their performances and the types of services offered in each case.

Related activities:
Activity 2: In-depth analysis of an aeronautical communication system

300248 - CA2-MN6 - Aeronautical Communications 2

Ground-Ground Communications and Aeronautical Communications Network	Learning time: 25h Theory classes: 7h Laboratory classes: 4h Self study : 14h

Description:

In the latter block the student sees the evolution of aeronautical telecommunication fixed network (AFTN) to ATN for different types of users (control centers, airports, centers communications, etc..), transmission media (telephone lines, coaxial, satellite links, radio links, optical fiber, etc..), type of information to be transmitted (voice or data) connection modes, suppliers and services (radar data, flight plan data, meteorology, monitoring and control of maintenance, etc.). We will explain the requirements of today's networks, the packet switching networks (CIDIN), data network Aena Air Navigation (REDAN), characteristics and network subsystems LINK 2000 + European, the advantages of using VoIP in aeronautical communications, and some aspects key communications network of the future European (SESAR).

Related activities:

Activity 2: In-depth analysis of an aeronautical communication system

Last update: 09-07-2018

300248 - CA2-MN6 - Aeronautical Communications 2

Planning of activities

LABORATORY PRACTICES

Hours: 17h
Laboratory classes: 12h
Self study: 5h

Description:
In the first part of the course, a series of laboratory practices are carried out with the objective that the student can verify the phenomena studied in the theoretical part of the subject to reality.

Support materials:
Practices guide.
Instructions manuals for laboratory equipment.
Data-sheets of the devices to measure.

Descriptions of the assignments due and their relation to the assessment:
The student (in groups of up to 3) must submit a report for each of the practices, which will be scored by the teacher. The weight of the evaluation of the reports is 12.5% of the marks of the course.

IN-DEPTH ANALYSIS OF AN AERONAUTICAL COMMUNICATION SYSTEM

Hours: 29h
Theory classes: 1h
Self study: 24h
Laboratory classes: 4h

Description:
The student will study in detail one of the aeronautical communications standards from a list given by teacher (or at the student group's proposal) and specialized reference materials (books and journals and reports of projects or standards reports). Work will be performed primarily outside school hours, in groups of three students.

Support materials:
Articles, books and other work-related information.

Descriptions of the assignments due and their relation to the assessment:
The group must submit a detailed report on the selected theme in presentation formet. The work will be reviewed by a group of other students asking questions about it. The author group will have to answer the questions correctly. The evaluation will account for both both the quality of the work and the level of the questions asked and answers given by the group. The teacher will have access to all this information and will track not only the progress of the work but also the questions and answers.

Specific objectives:
In the first place, this work allows students to an in-depth analysis of some issues explained to themor some aspect of aeronautical communications not explained in the lectures. It also puts them in touch with the literature on the subject and force them to select properly the information, how to process and how to search references to fully understand the problem. The writing of a dissertation taught them to be synthetic and highlight the most important aspects. Finally the assessment activity work of other students fosters the ability to be critical and self-critical

Qualification system

· 50% Exams. A half-semester exam 25% and end-of-semester exam 25%.
· 25% Laboratory during the first part of the course.
· 25% Report of Part 2 of the course.

Last update: 09-07-2018

300248 - CA2-MN6 - Aeronautical Communications 2

Bibliography

Basic:

Bará Temes, Javier. Circuits de microones amb línies de transmissió [on line]. Barcelona: Edicions UPC, 1993Available on: <http://hdl.handle.net/2099.3/36162>. ISBN 8476533381.

Bará Temes, Javier. Ondas electromagnéticas en comunicaciones [on line]. Barcelona: Edicions UPC, 1999Available on: <http://hdl.handle.net/2099.3/36205>. ISBN 8483013495.

Cardama Aznar, Ángel; Jofre Roca, Lluís; Rius Casals, Juan Manuel; Romeu Robert, Jordi; Blanch Boris, Sebastián; Ferrando Bataller, Miguel. Antenas [on line]. Segunda edición. Available on: <http://hdl.handle.net/2099.3/36797>. ISBN 9788483019900.

Stacey, Dale. Aeronautical radio communication systems and networks [Recurs electrònic] [on line]. Chichester, England ; Hoboken, NJ: Wiley, 2008Available on: <http://site.ebrary.com.recursos.biblioteca.upc.edu/lib/upcatalunya/detail.action?docID=10232954>. ISBN 9780470035092.