

Course guide

300213 - ITA - Air Transport Infrastructure

Last modified: 06/06/2024

Unit in charge: Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 748 - FIS - Department of Physics.

Degree: BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING (Syllabus 2015). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 7.5 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: Definit a la infoweb de l'assignatura.

Others: Definit a la infoweb de l'assignatura.

PRIOR SKILLS

Knowledge of the English language and technical vocabulary in English.

Knowledge corresponding to the subject of Aerospace Technology and Air Transport (1B).

REQUIREMENTS

It is very convenient that the students have a personal computer (ideally a laptop) with an Internet connection.

Have passed Aerospace Technology and Transport Aeri (1B)

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. CE 13 AERO. Comprender la singularidad de las infraestructuras, edificaciones y funcionamiento de los aeropuertos. (CIN/308/2009, BOE 18.2.2009)
2. CE 14 AERO. Comprender el sistema de transporte aéreo y la coordinación con otros modos de transporte. (CIN/308/2009, BOE 18.2.2009)
3. CE 17 AERO. Conocimiento adecuado y aplicado a la ingeniería de: Los elementos fundamentales de los diversos tipos de aeronaves ; los elementos funcionales del sistema de navegación aérea y las instalaciones eléctricas y electrónicas asociadas; los fundamentos del diseño y construcción de aeropuertos y sus diversos elementos. (CIN/308/2009, BOE 18.2.2009)
4. CE 19 AERO. Conocimiento aplicado de: la ciencia y tecnología de los materiales; mecánica y termodinámica; mecánica de fluidos; aerodinámica y mecánica del vuelo; sistemas de navegación y circulación aérea; tecnología aeroespacial; teoría de estructuras; transporte aéreo; economía y producción; proyectos; impacto ambiental. (CIN/308/2009, BOE 18.2.2009)
5. CE 9 AERO. Comprender la globalidad del sistema de navegación aérea y la complejidad del tráfico aéreo. (CIN/308/2009, BOE 18.2.2009)

Generical:

CG3. (ENG) CG3 - Instalación, explotación y mantenimiento en el ámbito de la ingeniería aeronáutica que tengan por objeto, de acuerdo con los conocimientos adquiridos, los vehículos aeroespaciales, los sistemas de propulsión aeroespacial, los materiales aeroespaciales, las infraestructuras aeroportuarias, las infraestructuras de aeronavegación y cualquier sistema de gestión del espacio, del tráfico y del transporte aéreo.

CG5. (ENG) CG5 - Capacidad para llevar a cabo actividades de proyección, de dirección técnica, de peritación, de redacción de informes, de dictámenes, y de asesoramiento técnico en tareas relativas a la Ingeniería Técnica Aeronáutica, de ejercicio de las funciones y de cargos técnicos genuinamente aeroespaciales.

CG2. (ENG) CG2 - Planificación, redacción, dirección y gestión de proyectos, cálculo y fabricación en el ámbito de la ingeniería aeronáutica que tengan por objeto, de acuerdo con los conocimientos adquiridos, los vehículos aeroespaciales, los sistemas de propulsión aeroespacial, los materiales aeroespaciales, las infraestructuras aeroportuarias, las infraestructuras de aeronavegación y cualquier sistema de gestión del espacio, del tráfico y del transporte aéreo.

CG8. (ENG) CG8 - Conocimiento, comprensión y capacidad para aplicar la legislación necesaria en el ejercicio de la profesión de Ingeniero Técnico Aeronáutico.

CG1. (ENG) CG1 - Capacidad para el diseño, desarrollo y gestión en el ámbito de la ingeniería aeronáutica que tengan por objeto, de acuerdo con los conocimientos adquiridos, los vehículos aeroespaciales, los sistemas de propulsión aeroespacial, los materiales aeroespaciales, las infraestructuras aeroportuarias, las infraestructuras de aeronavegación y cualquier sistema de gestión del espacio, del tráfico y del transporte aéreo.

Transversal:

6. 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.

7. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.

9. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

10. 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.

11. 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.

13. EFFECTIVE USE OF INFORMATION RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

Basic:

CB1. (ENG) CB1 - Que los estudiantes hayan demostrado poseer y comprender conocimientos en un área de estudio que parte de la base de la

educación secundaria general, y se suele encontrar a un nivel que, si bien se apoya en libros de texto avanzados, incluye también algunos aspectos que implican conocimientos procedentes de la vanguardia de su campo de estudio

CB2. (ENG) CB2 - Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posean las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de su área de estudio

CB3. (ENG) CB3 - Que los estudiantes tengan la capacidad de reunir e interpretar datos relevantes (normalmente dentro de su área de estudio)

para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social, científica o ética

CB4. (ENG) CB4 - Que los estudiantes puedan transmitir información, ideas, problemas y soluciones a un público tanto especializado como no especializado

CB5. (ENG) CB5 - Que los estudiantes hayan desarrollado aquellas habilidades de aprendizaje necesarias para emprender estudios posteriores con un alto grado de autonomía

TEACHING METHODOLOGY

The course combines the following teaching methodologies:

- Autonomous learning, because students will work on the self-study materials at home.
- Cooperative learning, because students will be organized in small groups (2-4 people) to carry out some of the course tasks.
- Project-based learning, because students will develop a team project (3-4 people) during the second half of the course.
- Self-evaluation and peer evaluation of some of the deliveries.

The hours of directed learning consist of doing theoretical classes in which the teaching staff exposes the content of the subject. At the same time, and through exercises and practical examples, it tries to motivate and involve the student body so that they actively participate in their learning and to complete the knowledge explained in the theoretical classes. In addition, laboratory practices will be carried out in groups of 2-3 people. The practices are designed to reinforce theoretical concepts and allow the development of basic instrumental skills in a laboratory and at the same time reinforce the generic competence of teamwork.

In general, after each session, tasks outside the classroom are proposed, such as guided readings and resolution of individual or group questions and problems, which must be worked on and which are the basis of guided and autonomous learning.

LEARNING OBJECTIVES OF THE SUBJECT

In this course, the technologies, infrastructures, organizational structures, and procedures that enable air navigation, as well as the safe, efficient, and economically viable management of air traffic, are introduced in an integrated and introductory manner.

Upon completion of the subject, the student must be able to:

- Understand the air navigation system, related infrastructures, main systems and specifications, operational and management procedures.
- Understand the different phases in air traffic management, including airspace management, air traffic flow management, and air traffic services; the main systems, operational and management procedures.
- Design basic instrument flight procedures.

"In this subject, the technologies, infrastructures, organizational structures, and procedures that enable air navigation and circulation, as well as the safe, efficient, and economically viable management of air traffic, are introduced in an integrated and introductory manner.

Upon completion of the subject, the student must be able to:

- Understand the air navigation and circulation system, related infrastructures, main systems and specifications, operational and management procedures.
- Understand the different phases in air traffic management, including airspace management, air traffic flow management, and air traffic services; the main systems, operational and management procedures.
- Design basic instrument flight procedures.
- Design a basic portion of airspace."

STUDY LOAD

Type	Hours	Percentage
Self study	105,0	56.00
Hours small group	56,5	30.13
Guided activities	26,0	13.87

Total learning time: 187.5 h

CONTENTS

CNS/ATM (Communications Navigation Surveillance for ATM)

Description:

High-level description of the main communication, navigation, and surveillance (CNS) systems (current and under development) for aeronautical applications. Identify limitations of current or conventional systems and improvements of systems in development or future, identifying different areas of ATM provision where they can have an impact. Economic and operational criteria for the placement of these CNS systems will be analyzed at a high level, as well as considerations regarding their maintenance and inspection (on the ground and in-flight). In particular, the following systems will be described at a high level:

- Communications: VHF, HF, SatCom, CPDLC, ACARS.
- Navigation: Radio aids, GNSS (including augmentation systems ABAS, SBAS, and GBAS).
- Surveillance: PSR, SSR, and ADS.

Provide a high-level description of the main systems (current and under development) to ensure separation between aircraft and collision avoidance systems: ASAS, ACAS, MTCD, STCA, GPWS, ...

- Maintenance and inspection (on the ground and in-flight) of CNS systems.
- Separation and collision avoidance (ACAS/ASAS).

Related activities:

- Activity 1: Videocast and classroom discussions. Topics:
 - . "Communication Navigation and Surveillance (CNS)"
 - . "Separation and collision avoidance"
- Activity 2: ATM use-cases (classroom discussion of use cases)
- Activity 3: Air traffic control practices.
- Activity 5: Project
- . WP3: Literature review.

Full-or-part-time: 20h 30m

Laboratory classes: 7h

Guided activities: 3h

Self study : 10h 30m

Airspace and flight procedures

Description:

- Airspace structuring and configuration, including flight information regions (FIR/UIR), types of airspace classes, types of control zones, restricted, dangerous, or prohibited areas, as well as their relationship with visual/instrument flight rules.
- Visual flight procedures: aerodrome traffic pattern, visual reference points, dead reckoning navigation.
- Instrument flight procedures: airways, departures (SIDs), arrivals (STARs), and approaches (precision, non-precision, and vertical guidance APV).
- Analysis of visual and instrument procedures.
- General criteria for the design of instrument procedures, obstacle clearance criteria, and limiting surfaces.
- Specific criteria for the design of instrument departures, arrivals, and approaches (including RNAV).

Related activities:

Activity 1: Videocast and classroom discussions. Topics:

- . "Visual and instrument flight procedures"
- . "IFR approaches"

Activity 2: ATM use-cases (classroom discussion of use cases)

Activity 3: Air traffic control practices.

Activity 4: Practical exercises:

- . Types and classes of airspace.
- . IFR routes.
- . Analysis of instrument approach charts.
- . IFR holding patterns and entry procedures.

Activity 5: Project:

- . WP1: Airspace and study of continuous climb/descent procedures.
- . WP2: Design of instrument procedures.

Full-or-part-time: 93h

Laboratory classes: 25h

Guided activities: 15h

Self study : 53h

Air navigation services

Description:

Performance measurement of the air traffic management system (KPA, KPI, performance management frameworks).

Aeronautical information services (AIP, NOTAM, and circulars).

Air traffic management services:

Airspace management (ASM): sectorization and opening schemes, creation of routes and procedures, civil-military coordination, flexible use of airspace (FUA).

Air traffic flow management (ATFM): capacity/demand balancing, regulations, techniques and algorithms (at a high level) for slot allocation, IATA slots, the Network Manager in Europe.

Air traffic services (ATS): alerting service, information service (ATIS, VOLMET, in-flight information service, and aerodrome information service - AFIS), control service (procedural control and radar control, control units, coordination of ATS services).

Separation: types of separation, RVSM, wake turbulence separation.

Collaborative Decision Making (CDM).

Related activities:

Activity 1: Videocast and classroom discussions. Topics:

- . "Introduction to air navigation services (ANS)"
- . "Airspace management (ASM)"
- . "Air traffic flow management (ATFM)"
- . "Air traffic services (ATS)"
- . "Separation and collision avoidance"

Activity 2: ATM use-cases (classroom discussion of use cases)

Activity 3: Air traffic control practices.

Activity 4: Practical exercises:

- . Searches in the AIP
- . NEST
- . ATS flight plans

Activity 5: Project:

- . WP1: Airspace and study of continuous climb/descent procedures.
- . WP3: Literature review.

Full-or-part-time: 75h 20m

Laboratory classes: 24h 30m

Guided activities: 9h 20m

Self study : 41h 30m

GRADING SYSTEM

The evaluation criteria defined on the subject's infoweb will be applied.

BIBLIOGRAPHY

Basic:

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- Federal Aviation Administration. Instrument procedures handbook [on line]. Oklahoma City: U.S. Department of Transportation, Federal Aviation Administration, Flight Procedure Standards Branch, 2007 [Consultation: 22/12/2022]. Available on: <https://web-p-ebSCOhost-com.recursos.biblioteca.upc.edu/ehost/ebookviewer/ebook?sid=7de3f7e4-8330-4f05-ab5e-627dc199b6dc%40redis&vid=0&format=EK>. ISBN 9781560276869.
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- Brenlove, Milovan S. The Air traffic system : a commonsense guide. 2nd ed. Ames: Iowa State Press, 2003. ISBN 0813829607.

Complementary:

- Galotti, Vincent P. The Future air navigation system (FANS): communication, navigation, surveillance, air traffic management. Aldershot, England: Avebury Aviation, 1997. ISBN 0291398332.
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