

Navigation and Air Traffic Control Techniques

Code: 101750
ECTS Credits: 6

Degree	Type	Year	Semester
2501233 Aeronautical Management	OB	3	2

Contact

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Teaching groups languages

You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

Prerequisites

To be able to assimilate the subject correctly, the knowledge of CNS (Communications, Navigation and Surveillance) given in the "telecommunications in the Aeronautical Sector" subject (second course) is requested.

Objectives and Contextualisation

This subject reviews new and traditional technologies applied to aviation. It consists of three blocks: air navigation fundamentals, navigation systems, and control techniques. In this way, an analysis of the main aspects of air navigation is carried out, starting with the study of the related sciences and then focusing on the areas the system is composed. Priority is given to air traffic control and navigation systems. Traditional, current and innovative technologies and procedures that arrive in the process of constant change that aviation is experiencing are analyzed, along with a prospection based on the key elements that are demanded from the ATM system of the future, which allow predicting, with some accuracy, its future evolution.

Competences

- Communication.
- Identify, develop and maintain the necessary resources to meet the tactical and operative needs inherent to air transport activities.
- Personal attitude.
- Personal work habits.
- Thinking skills.

- Use knowledge of the fundamental principles of mathematics, economics, information technologies and psychology of organisations and work to understand, develop and evaluate the management processes of the different systems in the aeronautical sector.
- Use new technologies in airline management.

Learning Outcomes

1. Assess the performance of the new ADS-B technology.
2. Communicate knowledge and findings efficiently, both orally and in writing, both in professional situations and with a non-expert audience.
3. Critically assess the work done.
4. Describe new navigation systems.
5. Describe the new aircraft-tower communications: Datalink.
6. Develop critical thought and reasoning.
7. Develop curiosity and creativity.
8. Develop independent learning strategies.
9. Develop the ability to analyse, synthesise and plan ahead.
10. Identify the aeronautical environment.
11. Identify the potential benefits of the new 4D trajectory management.
12. Identify the technological resources necessary for the airside management of operations in the terminal control area.
13. Identify the technology that aircraft must have on board to meet needs of communication, navigation and surveillance.
14. Maintain a proactive and dynamic attitude towards career progression, personal growth and continuous professional development. Have the will to succeed.
15. Make efficient use of ICT in communicating ideas and results.
16. Manage routes in accordance with the new ATFM manual.
17. Manage time and available resources. Work in an organised manner.
18. Understand the new surveillance systems.
19. Use English as the primary language of professional communication.
20. Work independently.

Content

Contents Theoretical Classes

Theory Block I: FUNDAMENTALS OF AIR NAVIGATION

Unit 1: CONCEPT OF AIR NAVIGATION.

- pre-flight planning
- positioning
- guided
- route concept
- flight plan
- on-board instruments
- types of navigation

Unit 2: CARTOGRAPHY AND GEODESY.

- earth movements and their effects
- time systems
- Earth's magnetic field
- geographic reference systems
- the scale
- cartographic projections

- aeronautical charts
- drift

Unit 3: METEOROLOGY.

- the atmosphere
- ISA
- wind
- cloud types
- front areas
- pressure changes
- turbulence, dew point, icing, shear

Unit 4: RADIO WAVES.

- basic concepts
- electromagnetic spectrum

Unit 5: AIR CIRCULATION.

- general concept
- position reports
- ATC objectives
- international regulations
- national and community legislation
- flight rules
- flight levels

Unit 6: AIR SPACES.

- airspace classes
- aerial areas

Theory II Block: AIR NAVIGATION SYSTEM

Unit 7: ANS GENERAL CONCEPTS.

- ultimate goal of air navigation
- regulatory bodies and ANSPs (SES)
- ANS functional areas
- temporary processes

Unit 8: COMMUNICATIONS (COM).

- aeronautical fixed service
- aeronautical mobile service
- aeronautical messages
- Aeronautical mobile satellite service
- aeronautical broadcasting service
- aeronautical radionavigation service
- separation of aeronautical frequencies
- CPDLC system

Unit 9: NAVIGATION (NAV).

- conventional systems
- satellite systems
- RNAV and RNP concepts
- PBN concept
- GNSS concept
- augmentation systems
- free flying and free route airspace (FRA)

Unit 10: AIR SURVEILLANCE (SOUTH).

- General concepts

- types of radars
- multilateration
- ADS

Unit 11: AERONAUTICAL METEOROLOGY SERVICE (MET).

- weather reports
- decoding messages
- meteorological offices

Unit 12: AERONAUTICAL INFORMATION SERVICE (AIS).

- products and publications

Unit 13: SEARCH AND RESCUE (SAR).

- organizational structure
- alert phases

Unit 14: MANAGEMENT OF AIR TRAFFIC (ATM).

Theory III Block: AIR TRAFFIC CONTROL TECHNIQUES

Unit 15: ATM GENERAL CONCEPTS.

- general definition
- main indicators

Unit 16: MANAGEMENT OF AIRSPACE (ASM).

- principles and strategies
- flexible use of airspace (FUA)
- time phases
- RPAS integration
- U-space concept

Unit 17: MANAGEMENT OF THE AIRFLOW AND CAPACITY OF THE AIRSPACE (ATFCM).

- principles and objectives
- time phases
- regulatory measures
- CFMU
- air delays

Topic 18: AIR TRAFFIC SERVICES (ATS)

- main objectives
- FIC
- ALR
- ATC
- TWR aerodrome control service
- ACC area / route control service
- APP approach control service
- minimum separation by time and distance
- TBS concept
- RVSM concept
- conflict alert systems
- remote control towers

Methodology

The general methodological approach of the subject is based on the principle of multivariate strategies, so it is intended to facilitate the active participation and the construction of the learning process by the student. In this sense, lectures will be considered in a whole group, practical activities, participatory debates and follow-up processes of the student's work.

In order to develop the subject and seminars, "Power Point" presentations and short videos will be used.

All the subjects are complemented with practical sessions of laboratory. Also distributed to the material students to do the exercises: Aeronautical Letters, Sheets of Loading ...

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
Type: Directed			
Sessions of practical problems	15	0.6	3, 1, 18, 4, 5, 8, 9, 7, 6, 17, 12, 10, 13, 14, 20
Theory Classes	30	1.2	1, 18, 4, 5, 8, 9, 6, 16, 12, 10, 13, 11, 20
Type: Supervised			
Seminars	5	0.2	9, 7, 6, 16, 10, 11
Type: Autonomous			
Development research work	30	1.2	3, 18, 2, 4, 5, 8, 9, 7, 6, 15, 17, 10, 13, 11, 14, 20, 19
Seminars Preparation	20	0.8	3, 2, 8, 9, 7, 6, 15, 17, 14, 20, 19
Study	45.5	1.82	3, 1, 18, 4, 5, 8, 9, 7, 6, 17, 16, 12, 10, 13, 11, 14, 20, 19

Assessment

The single assessment system is not foreseen in this subject.

The evaluation process for this subject will consist of:

1. Continuous Assessment (60%)

Composed of problems carried out in the classroom, laboratory practices, assignments or cases, and checkpoints. It could vary depending on the final schedule but, in total, this part will contribute 60% of the grade

3. Exam (40%)

Calculation of the final grade:

- If $CA \geq 4$ AND $EX \geq 3.5$, the final grade (G) will be: $G = 40\%(EX) + 60\%(CA)$
- If $EX < 3.5$ OR $CA < 4$ OR $G < 5 \rightarrow G = \text{MIN}(40\%(EX) + 60\%(CA); 4.5)$.
- Pass the subject if $G \geq 5$. Fails if $G < 3.5$. In the intermediate case ($3.5 \leq G < 5$), the student can do the retake process detailed below.

Dates of continuous assessment and delivery of assignments will be published on the Virtual Campus and may be subject to possible changes in programming for any reason, although they will always be informed sufficiently in advance.

Conditions for approval and recovery mechanisms

To pass the course it will be necessary to obtain at least 5 points out of 10. There will only be a retake from the theory exam.

The student can appear for the retake as long as they have been submitted to a set of activities that represent at least two thirds of the total grade for the course. Of these, students who have an average of 2.5 or higher on all the activities of the subject may be presented in the retake.

Special Grades

Awarding an honors degree is the decision of the teaching staff responsible for the subject. UAB regulations indicate that Honors can only be granted to students who have obtained a final grade equal to or greater than 9.00. Up to 5% MH of the total number of students enrolled can be awarded.

A student will be considered non-assessable (NA) if the weight of those equivalent to a minimum of two-thirds of the total grade for the course has not been presented in a set of activities.

Ethical considerations and disciplinary measures

Without prejudice to other disciplinary measures deemed appropriate, and in accordance with current academic regulations, irregularities committed by the student that may lead to a variation in the grade of an act of evaluation will be rated with a zero. Therefore, copying or letting a practice or any other assessment activity be copied will involve suspending with a zero, and if it is necessary to pass it to pass, the entire subject will be suspended.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Checkpoints	30%	1	0.04	1, 18, 4, 5, 8, 7, 15, 17, 16, 12, 10, 13, 11, 19
Problems solving and Laboratory Practices	30%	1.5	0.06	3, 1, 18, 2, 4, 5, 8, 9, 7, 6, 15, 17, 16, 12, 10, 13, 11, 14, 20
Theory Exam	40%	2	0.08	3, 1, 18, 2, 4, 5, 8, 9, 7, 6, 15, 17, 16, 12, 10, 13, 11, 14, 20, 19

Bibliography

Warning: See virtual campus for extensions and updates of this bibliography

Basic bibliography

- ICAO annexes
- ICAO Doc. 9750, Global Air Navigation Plan
- ICAO Doc. 9613, Performance-based Navigation (PBN) Manual
- ICAO Doc. 9849, Global Navigation Satellite System (GNSS) Manual
- ICAO Doc. 9854, Global Air Traffic Management Operational Concept
- ICAO Doc 4444 'Procedures for Air Navigation Services - Air Traffic Management' (PANS-ATM)
- European ATM Master Plan

- Air Navigation Rules of Spain
- SERA (Standardised European Rules of the Air)
- "Navegación aérea: posicionamiento, guiado y gestión del tráfico aéreo" - SÁEZ NIETO, Francisco Javier
- "Descubrir la navegación por satélite" - DE MATEO GARCÍA, María Luz
- "Descubrir el control aéreo" - ONTIVEROS, Jorge
- "Fundamentals of air traffic control" - NOLAN, Michael S.

Complementary bibliography

- Pilot's Handbook of Aeronautical knowledge (FAA).
- Aeronautical Information Manual (FAA).
- Global Operational Data Link Documento (OACI).
- Link 2000+ Guidance to Airborne Implementers (Eurocontrol).
- ATC Fecha Link Operational Guidance for LINK 2000+ Services (Eurocontrol).
- Flight Crew Fecha Link Operational Guidance for LINK 2000+ Services (Eurocontrol).
- Air traffic controllers ab-initio course (SENASA)
- "Mecánica del vuelo" - GÓMEZ TIERNO, Miguel Ángel
- "Aerodinámica básica" - MESEGUER RUIZ, José

Software

None