

# Course guide 220008 - ENIA - Airspace, Air Navigation and Infrastructure

			Last modified: 19/04/2023
Unit in charge:	Terrassa School of Industr	rial, Aerospace and Audiovisual Engineering	
Teaching unit:	220 - ETSEIAT - Terrassa	School of Industrial and Aeronautical Engineering.	
Degree:	BACHELOR'S DEGREE IN A	AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 20	10). (Compulsory subject).
	BACHELOR'S DEGREE IN A	AEROSPACE VEHICLE ENGINEERING (Syllabus 2010).	(Compulsory subject).
Academic year: 2023	ECTS Credits: 4.5	Languages: Catalan	

LECTURER				
Coordinating lecturer:	Enrique García Melendo			
Others:	Jon Tugores, Xavier Roca, Joan Antoni Castillo			

## **DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES**

#### Specific:

1. GrETA/GrEVA - An overall understanding of air navigation systems and the complexity of air traffic

CE13. GrETA/GrEVA - An understanding of the uniqueness of airports in terms of infrastructure, structures and operation

CE14. GrETA/GrEVA - An understanding of air transport systems and coordination with other modes of transport.

CE17-GRETA. GrETA/GrEVA - An adequate understanding of the following, as applied to engineering: fundamental elements of the various types of aircraft; functional elements of air navigation systems and related electrical and electronic installations; the basics of the design and construction of airports and their various elements

#### **Basic:**

CB05-GRETA. That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

## **TEACHING METHODOLOGY**

In the theoritical classes teachers will explain concepts, methods and results, showing them with some examples to facilitate understanding.

The sessions in the classrooms the teacher guide the student in applying theoretical concepts to workgroup.

## LEARNING OBJECTIVES OF THE SUBJECT

Know the organization of the air transport system and air navigation system, their rules and the institutions that regulate these systems, and the elements of the air navigation and their relationship with the airport.

Particularly, to understand the air space structure, the instrumental navigation techniques, the procedures used by airplanes in the controlled air space, the navigations aids and their relationship with the airport both from standpoint of design and operation.

## **STUDY LOAD**

Туре	Hours	Percentage
Hours large group	31,0	27.56
Hours medium group	14,0	12.44
Self study	67,5	60.00

Total learning time: 112.5 h



## **CONTENTS**

## 1. Introduction to air navigation

## **Description:**

1.1 Definitions1.2 History1.3 Air navigation techniques

Related activities: Theory lectures

**Full-or-part-time:** 10h Theory classes: 2h

Self study : 8h

#### 2. Flight basic instruments

## **Description:**

2.1 Anemometer, altimeter and vertical speed indicator2.2 Attitude indicator, artificial horizon and direction indicator2.3 Others

Related activities: Theory and practice lectures

Full-or-part-time: 11h Theory classes: 3h Practical classes: 2h Self study : 6h

## 3. Institutional framework

#### **Description:**

3.1 Basic regulation

- 3.2 National agencies
- 3.3 International agencies

Related activities: Theory lectures

**Full-or-part-time:** 9h Theory classes: 2h Self study : 7h



### 4. Air navigation systems

## **Description:**

4.1 Visual flight
4.2 Instrumental flight with VORD/DME
4.3 Instrumental flight with NDB
4.4 Instrumental flight with ILS
4.5 Onboard Systems (ACAS, GPWS)
4.6 Autonomous systems (INS)

Related activities: Theory and practice lectures

**Full-or-part-time:** 18h 30m Theory classes: 7h Practical classes: 4h Self study : 7h 30m

## 5. Airspace

## Description:

5.1 Division of the airspace5.2 Classification of the airspace

Related activities: Theory lectures

**Full-or-part-time:** 16h Theory classes: 4h Self study : 12h

## 6. Navigational charts, flight plans and weather service

**Description:** 6.1 Navigational charts 6.2 Flight plans 6.3 Weather service

Related activities: Theory and practice lectures

**Full-or-part-time:** 11h Theory classes: 3h Practical classes: 2h Self study : 6h



## 7. Air navigation services

## **Description:**

7.1 Air Traffic Control service (ATC)7.2 Flight Information Service (FIS)7.3 Advisory Service7.4 Alert Service

Related activities: Theory lectures

**Full-or-part-time:** 10h Theory classes: 2h Self study : 8h

## 8. Special activities in airspace

**Description:** 8.1 UAV

Related activities: Theory and practice lectures

**Full-or-part-time:** 14h Theory classes: 4h Practical classes: 2h Self study : 8h

## 9. Airport infrastructures

## **Description:**

9.1 Construction of airport infrastructure9.2 Examples of airport infrastructure

Related activities: Theory lectures

**Full-or-part-time:** 13h Theory classes: 4h Practical classes: 4h Self study : 5h



## **ACTIVITIES**

## 1. Theory/practice classes

#### **Description:**

Pre and post lecture preparation and class attendance. Class demonstrations with software support to perform flight simulations.

#### Specific objectives:

Transferrig the necessary knowledge for a correct interpretation of the developed contents during theory sessions, and answers to questions related to the course syllabus.

## Material:

1. Recommended textbooks found in the course bibliography

- 2. Related technical articles.
- 3. Support web pages.

## **Delivery:**

This activity is related to midterm and final exams

## Full-or-part-time: 105h

Theory classes: 23h 30m Practical classes: 14h Self study: 67h 30m

## 2. Airport infrastructure practice session

#### **Description:**

Practice session performed in classroom related to airrport infrastructures

#### Specific objectives:

To extend the presented contents in the theory sessions.

Material: Support webpages

## **Delivery:**

Students will develop a practice in classroom with the professor's suport. Assessment of this activity will be a 10% of the final grade.

**Full-or-part-time:** 1h 30m Theory classes: 1h 30m

## 4. Mid-term exam

Full-or-part-time: 3h Theory classes: 3h



#### 4. Final exam

**Description:** It will consist on an individual exam in the classroom

**Specific objectives:** To develope and show the knowledge acquired during theory and practice sessions.

Material: Exam statement

**Delivery:** Resolved exam on the exam statements handed out to the student.

Full-or-part-time: 3h Theory classes: 3h

## **GRADING SYSTEM**

The final grade is the sum of the following grades:

Final grade = 0.1 \* Act + 0.45 \* ExPar + 0.45 \* ExFinal

Act: grade of the infrastructures report ExPar: midterm exam grade ExFinal: final exam grade

Students who did not take the midterm exam, or want to improve the grade obtained in the midterm exam, will have the option to improve

or recover the result in the final exam. In this case the final grade will be:

Final grade = 0.45 \* Max [ExPar, (0.8 \* ExRec + 0.2 \* ExPar1)] + 0.45 \* ExFinal + 0.1 \* Act

ExRec = Recovery exam. Max = Maximum.

In other words, the midterm mark will improve as long as it is higher.

## **EXAMINATION RULES.**

Except at the exam, the teacher is available to be consulted and it's possible to discuss the activities with the other students. A forum in ATENEA is enable to discuss and share information between the students or to ask for help from other students.

## BIBLIOGRAPHY

**Basic:** 

- " Reglamento de circulación aérea". Mapelli López, Enrique [et al.]. Legislación aérea. Madrid: Tecnos, 2004.
- Adsuar Mazón, J. C. Circulación aérea. Madrid: Paraninfo, 1994. ISBN 8428321205.
- Sáez Nieto, Francisco Javier [et al.]. Sistemas y equipos para la navegación y circulación aérea. MAdrid: Universidad Politécnica, 1995.
- Nolan, Michael S. Fundamentals of air traffic control. 4th ed. Belmont: Thomson--Brooks/Cole, 2004. ISBN 0534393756.

- Kayton, Myron; Fried, Walter R. Avionics navigation systems [on line]. 2nd ed. New York: Wiley, 2007 [Consultation: 13/06/2022]. Available on: <u>https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/9780470172704</u>. ISBN 9780470172704.

- Skolnik, Merrill I. Radar handbook. New York: McGraw-Hill, 2008. ISBN 9780071485470.

#### **Complementary:**



- Internacional Civil Aviation Organization. Operación de aeronaves: normas y métodos recomendados internacionales: anexo 6 al convenio sobre aviación civil internacional. Madrid: OACI, 1998.

- International Civil Aviation Organization. Reglamento del aire: normas internacionales: anexo 2 al convenio sobre aviación civil internacional. 9a ed. Madrid: OACI, 1990.

- International Civil Aviation Organization. Telecomunicaciones aeronáuticas: normas y métodos recomendados internacionales : anexo 10 al convenio sobre aviación civil internacional. 3a ed. Madrid: OACI, 1995.

- Gil Diez, J.M. ATC control de tráfico aéreo. Madrid: Paraninfo, 1984. ISBN 9788428312882.

- Skolnik, Merrill I. Introduction to radar systems. 3rd ed. Boston: McGraw-Hill, 2001. ISBN 0072909803.
- Sáez Nieto, F.J [et al.]. La navegación aérea y el aeropuerto. Madrid: Fundación Aena, 2002. ISBN 8495567091.

## **RESOURCES**

#### Hyperlink:

- www.eurocontrol.int. Eurocontrol
- www.icao.int. International Civil Aviation Organization
- www.aena.es. Aeropuertos Españoles y Navegación Aérea
- www.ignss.org. International Global Navigation Satellite System Society
- www.esa.int. European Space Agency