

**TEACHING GUIDE**  
**AIR NAVIGATION**

**DEGREE IN AEROSPACE ENGINEERING IN AIR  
NAVIGATION**

**ACADEMIC YEAR 2012-13**

Date: 10-01-2013



<b>I.-Subject Identification</b>	
<b>Type</b>	OBLIGATORIA
<b>Teaching period</b>	2 curso, 2Q semestre
<b>Nº of credits</b>	6
<b>Language in wich the subject is taught</b>	English

<b>II.-Presentation</b>
<p>The air navigation is the process of steering an aircraft in flight from an initial position to a final position, following a determined route and fulfilling certain requirements of safety and efficiency. As a whole, it constitutes a complex system that requires juridic, operative and technical support frameworks to regulate its activity.</p> <p>The main goal of the air navigation system is to make possible air transportation day after day by means of providing the required services to perform operations safely and efficiently. These services are provided based on an organization, human resources, technical means, and a defined modus operandi. The so constituted system is referred to as CNS-ATM (Communications, Navigation &amp; Surveillance-Air Traffic Management). Therefore, CNS corresponds to the required technical support to fulfill air navigation's main goal, while ATM refers to the organization scope and the definition of operational procedures.</p> <p>In this course the focus will be first on the navigation process of an aircraft, which can be decomposed into flight planning, positioning, and guidance and control. Secondly, the focus will be on analyzing how the aircraft can navigate within the vicinity of other aircraft, i.e., the focus will be on analyzing the ATM system, in particular on air traffic control and air traffic flow management.</p>

<b>III.-Competences</b>
<b>Generic competences</b>
CG1. Ability to solve mathematical problems that may arise in relation to engineering. Ability to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and in partial derivatives; numerical methods; numerical algorithms; statistics and optimisation.
<b>Specific competences</b>

CE3. Understanding of the global nature of the air navigation system and complexity of air traffic.

CE11. Suitable and applied knowledge to the engineering of: the fundamental elements of the different types of aircraft; functional elements of air navigation systems and associated electrical and electronic installations; fundamental principles of the design and construction of airports and their different elements.

CE12. Suitable and applied knowledge of the engineering of: the fundamental principles of fluid mechanics; basic principles of flight control and automisation; principal features and physical and mechanical properties of materials.

CE14. Suitable and applied knowledge of the engineering of: The basic functional elements of Air Navigation systems; embarking and land equipment needs for correct operation.

CE16. Suitable and applied knowledge of the engineering of: the fundamental principles of sustainability, maintainability and operation of air navigation systems.

CE17. Suitable and applied knowledge of the engineering of: airspace system flight operations; environmental impact of infrastructure; planning, design and implementation of systems to support their traffic control.

CE18. Suitable and applied knowledge of the engineering of: Methods of air navigation calculation and development; calculation of specific air navigation systems and infrastructure; aircraft performance, manoeuvring and control; applicable legislation; functioning and management of air transport; navigation and air traffic control systems; air communications and surveillance systems.

CE20. Navigation systems; electrical installations for land and air; flight mechanics; Cartography; Cosmography; Meteorology; distribution, management and economics of air transport.

CE22. Ability to communicate effectively in the relevant foreign language used professionally.

CE23. Knowledge of scientific-technical language and the basics of transferring scientific-technical results for use in drafting professional documents and records, as well as for presentations. Ability to use information systems to search for reference material or information related to engineering.

**IV.-Contents**

**IV.A.-Syllabus**

Block I

Topic I: Introduction to navigation

Topic II: Flight planning and routes

Topic III: Positioning by situation surfaces

Topic IV: Estimation algorithms and positioning

Topic V: Guidance and control

Block II

Topic VI: Introduction to air circulation and air traffic management

Topic VII: Air traffic control

Topic VIII: Air traffic flow management

**IV.B.-Compulsory activities (assessable)**

Type	Title
Reading	Lecture sessions
Practical / Problem solving	Exercises sessions
Laboratories	Laboratory sessions
Others	Visit
Others	Seminars
Others	Assignments

<b>V.-Student workload</b>		
Lecture classes	24	
Practical classes/problem-solving, case studies, etc.	6	
Practical sessions in technological laboratories, hospitals, etc.	14	
Tests	4	
Academic tutorials	8	
Related activities: conferences, seminars, etc.	4	
Preparation of lecture classes	40	
Preparation of practical classes, problem-solving, case studies, etc.	30	
Test preparation	20	
Total student workload	150	
<b>VI.-Teaching Methodology and Organisation</b>		
Type	Period	Content
Theoretical classes	Semana 1 to Semana 16	Lecture sessions
Practical classes	Semana 1 to Semana 16	Laboratory sessions
Seminars	Semana 10 to Semana 12	Seminars
Group work	Semana 1 to Semana 16	Assignments
Other activities	Semana 10 to Semana 12	Visit

**VII.-Assessment methods**

**VII.A.-Continuous assessment**

The evaluation system of degrees in the EEES framework is continuous assessment.

In the continuous assessment system, class attendance is compulsory and its assessment within the process of continuous assessment will be established by the teachers in each subject.

**% Minimum class attendance: 80%**

(If a student is not allowed to sit for a test because he/she has attended less than 80% of the classes, this must be justified by using some type of proof)

Only those evaluation activities used by the teacher in the assessment design should be indicated in the table, considering:

**Comments**

Assessment activity	Limit	Percentage	Date	Contents
Assignments	No	30%	Todo el curso	
Laboratories	No	20%	Todo el curso	
Final exam	5.0	50%	Semana 17	

**VII.B.-Percentage for the assessment of part-time students**

To be assessed using this method, the student should obtain "Academic Exemption" for the subject, applying for it to the Dean or Director of the Faculty/School in which the subject is taught."Academic Exemption" does not exclude students from continuous assessment. This kind of assessment will be decided by the teacher, assisted by the degree coordinator. The syllabus adaptation will be established in accordance with the characteristics of each specific case.

**VII.C.-Revision of the assessment tests**

A fundamental element in this new teaching-learning system and continuous assessment is the permanent feedback that students receive regarding their work. This entails giving students accurate, objective and immediate information concerning the results of their performance, in order to monitor their effort and regulate their work, at the same time that this information offers a motivating element. With this goal in mind, teachers will have to establish a revision procedure of the tests and activities, indicating in each case and depending on the characteristics, the way in which this revision will be carried out, either in the classroom or during the subject tutorial.

**VII.-Bibliography**

**Generic**

Title: Navegación aérea: Posicionamiento, guiado y gestión del tráfico aéreo. Author: Francisco Javier Sáez Nieto Publisher: Garceta, 2012

Title: La navegación Aérea y el Aeropuerto. Author: F.j. Sáez Nieto, L.Pérez Sanz y V.F. Gómez Comendador. Publisher: Fundación AENA.

Title: The Future Air Navigation System Author: V.P. Galotti Publisher: Ashgate

Title: Avionics Navigation Systems Author: M. Kayton, W.R. Fried Publisher: Willer & Sons

**Complementary**

Title: Descubrir la navegación aérea Author: Francisco J. Sáez y Yolanda Portillo Publisher: Fundación AENA

Title: Descubrir el control aéreo Author: Jorge Ontiveros Publisher: Fundación AENA

Title: Understanding mathematics for aircraft navigation Author: J.S. WOLPER Publisher: McGraw Hill

Title: Fundamentals of Air Traffic Control Author: M.S. Nolan Publisher: Delmar

Title: Aircraft Communications and navigation systems Author: Mike Tooley and David Wyatt Publisher: Routledge

Title: Air Navigation Author: F.P. Miller Publisher: alphascript

**IX.-Lecturers/Teachers/Professors**

<b>Lecturer/teacher/professor's name</b>	Manuel Soler
<b>E-mail address</b>	manuel.soler@urjc.es
<b>Department/field</b>	Teoría de la Señal y Comunicaciones
<b>Category</b>	Profesor Visitante
<b>Academic qualifications</b>	Licenciado/Ingeniero
<b>Subject Coordinator</b>	Yes
<b>Academic tutorial timetable</b>	According to demand
<b>Nº of Quinquenios</b>	0
<b>Nº of Sexenio</b>	0
<b>Stretch Docencia</b>	0