

TEACHING GUIDE
AIR NAVIGATION SYSTEMS

**GRADO EN INGENIERÍA AEROESPACIAL EN
AERONAVEGACIÓN (INGLÉS)**

ACADEMIC YEAR 2013-14

Date: 17-07-2013

I.-Subject Identification	
Type	OBLIGATORIA
Teaching period	3 course, 2Q semester
Nº of credits	6
Language in wich the subject is taught	English

II.-Presentation
<p>Aeronautical communications, navigation, and surveillance (CNS) systems are key to the delivery of safe and efficient air traffic management. This module delves into three connected concepts, through the comprehensive study of systems which make possible the CNS paradigm.</p> <p>Ground and satellite radio navigational equipment enables pilots to use their instrumentation to fly precisely along their intended route and to conduct precision approach and landing. Satellite based systems and supporting procedures are of growing in importance to navigation. Therefore, more than one-third of the course is dedicated to Global Navigation Satellite Systems (GNSS).</p> <p>Surveillance systems are used by ATC and others to determine the position of aircraft and provide safe separation.</p> <p>The course will be developed by continuous references to their sister subjects of avionics and telecommunications with the intention of developing a solid knowledge of navigation systems.</p>

III.-Competences
Generic competences
<p>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.</p> <p>CG2. Understanding and mastering of the basic concepts relating to the general laws of mechanics, thermodynamics, electromagnetic fields and wavelengths and their application to solving engineering problems.</p>
Specific competences
<p>CE3. Understanding of the global nature of the air navigation system and complexity of air traffic.</p> <p>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.</p> <p>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.</p> <p>CE19. Applied knowledge of: transmitters and receivers; transmission lines and signal sending systems for air navigation;</p> <p>CE28. Ability to analyse the basic principles and parameters of radio navigation systems, with special emphasis on satellite systems.</p>

IV.-Contents

IV.A.-Syllabus

1. Introduction to aircraft navigation

Contents summary. Contextualization: How this module is related to the other modules. Review of basic concepts of air navigation. Communications, Navigation, and Surveillance.

2. Radio navigation systems

ADF, VOR, DME, ILS, MLS, Loran-C. System integration.

3. Dead reckoning systems

Doppler Shift, Inertial Systems, System integration.

4. Global Navigation Satellite Systems

Problem statement. GPS operation. Communications issues. GPS receiver. Error sources, accuracy and precision. Augmentation systems. Galileo. Other systems. System integration.

5. Flight Management Systems

Theory of Operation. System integration.

6. Surveillance

Air Traffic Control System, PSR, SSR, and TCAS.

IV.B.-Training activities

Type	Title
Reading	Assignments
Practical / Problem solving	GNSS

V.-Student workload		
Lecture classes	36	
Practical classes/problem-solving, case studies, etc.	6	
Practical sessions in technological laboratories, hospitals, etc.	4	
Tests	2	
Academic tutorials	6	
Related activities: conferences, seminars, etc.	6	
Preparation of lecture classes	30	
Preparation of practical classes, problem-solving, case studies, etc.	30	
Test preparation	30	
Total student workload	150	
VI.-Teaching Methodology and Organisation		
Type	Period	Content
Theoretical classes	Week 1 to Week 15	Lectures and Tutorials
Practical classes	Week 9 to Week 12	GNSS Laboratory
Other activities	Week 10 to Week 10	Seminar on system integration
Other activities	Week 13 to Week 13	Airbus factory tour

VII.-Assessment methods

VII.A.-Continuous assessment

Regular Evaluation:: If the teacher requires mandatory attendance, it should be precisely specified.

(Note: to avoid admitting a student to an exam who does not meet the minimum attendance requirement, professor must prove so by means of the use of a probative system, such as a signature sheet or the attendance control system available via the Virtual Classroom).

The distribution and characteristics of the assessment tests are those described below. Only in exceptional and especially justified cases may the professor introduce adaptations to the Guide. Said changes will require, after consulting the Head of the Course, the express prior authorisation of the Coordinator of the Degree Programme, who shall notify the Vice-Chancellor responsible for Academic Planning of the change made. In any event, the amendments proposed must follow what is established in the verified memory. For said changes to be effective, they must be duly communicated at the start of the course to the students through the Virtual Classroom.

Extraordinary Evaluation: Those students who have not succeeded at the ordinary assessment, or have not taken the subject exams, will have to do a make-up exam to verify the acquisition of the tasks set out in the guide.

Description of the tests for assessment and their weights.

Assignments 40%
GNSS lab 20%
Final Exam 40%

VII.B. Evaluation of Students with Academic Exemption

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' may be granted only if the characteristics of the subject allow so. Once the granting of Academic Exemption has been notified, the professor must inform the student through the Virtual Classroom about the assessment plan established in each case.

Academic Exemption possible in this subject: Yes

VII.C. Revision of examinations

In accordance with the regulation of examination revision of the University Rey Juan Carlos.

VII.D.-Disabled students or students with special needs

The Assistance for the Disabled Service, according to the regulations of this Service, approved by the Governing Council of the Rey Juan Carlos University, will provide the guidelines for the curricular adaptations for students with disabilities or special needs, in order to guarantee equal opportunities, non-discrimination, universal accessibility and better academic success. For this reason, this University is required to issue a report of curricular adaptations. In order to do so, disabled students or students with special needs must contact this service to analyze different alternatives.

VII.E.-Rules of Conduct

Rules of Conduct

VII.-Bibliography
Referecense Generic
Aircraft Communications and Navigation Systems. Mike Tooley and David Wyatt. Ed. Routledge.
Avionics Navigation Systems. Myron Kayton. Walter R. Fried. Ed. Wiley
Reference literature
Civil Avionics Systems. Ian Moir. Allan Seabridge. AIAA Education Series.

IX.-Lecturers/Teachers/Professors	
Lecturer/teacher/professor´s name	EDUARDO DEL ARCO FERNANDEZ
E-mail address	eduardo.delarco@urjc.es
Department/field	Teoría de la Señal y las Comunicaciones y Sistemas Telemáticos y Computación
Category	Profesor Ayudante Doctor
Academic qualifications	Doctor
Subject Coordinator	Yes
Academic tutorial timetable	Para consultar las tutorias póngase en contacto con el/la profesor/-a a través de correo electrónico
Nº of Quinquenios	0
Nº of Sexenio	0
Stretch Docentia	0