1. BASIC DATA

Course	Navigation Systems II
Degree	Aerospace Engineering in Aircrafts
School/ Faculty	Architecture, Engineering and Design
Course	Second Course
ECTS	6 ECTS
Type	Mandatory
Language/s	English
Delivery mode	Face to face
Semester	Second Semester
Academic Course	2019/2020
Coordinating professor	Víctor Manuel Padrón Nápoles

2. PRESENTATION

This course belongs to the "Aerospace systems and infrastructures" module:

1. Aerospace Technology 6 ECTS (first academic year)
2. Navigation Systems I 6 ECTS (first academic year)
3. Navigation Systems II 6 ECTS (second academic year)
4. Air Transport 6 ECTS (second academic year)

The course includes next topics: Navigation Systems, their main components and subsystems. Avionics.

3. COMPETENCIES AND LEARNING OUTCOMES

Core competencies:

- CB2. That students can apply their knowledge to their work or vocation in a professional manner and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study.
- CB3: That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.
- CB5: That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

Cross-curricular competencies:

- CT1: Ability to design, development and management in the field of aeronautical engineering aimed, according to the knowledge acquired as provided in paragraph 5 of the Decree CIN/308/2009, aerospace vehicles.

- CT12. Knowledge of basic subjects and technologies, which will enable you to learn new methods, theories and technologies, as well as to give you great versatility to adapt to new situations (autonomous learning).
- CT19. Work in interdisciplinary teams, providing the greatest effectiveness on the basis of cooperation, assuming their role within the team, establishing good relationships and exchanging information, and practicing the culture of peace and solidarity (Teamwork).

Specific competencies:

- CE17. Adequate knowledge and applied to the engineering of: The fundamental elements of the various types of aircraft; the functional elements of the air navigation system and associated electrical and electronic installations; the fundamentals of the design and construction of airports and its various elements.
- CE18. Adequate knowledge and applied to the Engineering of: The fundamentals of fluid mechanics; the basic principles of flight control and automation; the main characteristics and physical and mechanical properties of the materials.
- CE19. Applied knowledge of: the science and technology of materials; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation and air circulation systems; aerospace technology; structure theory; air Transport; economy and production; Projects; environmental impact.

Learning outcomes:

- LO1: Develop software for the control of the various elements of aircraft, and for the various instruments.
- LO2: To conduct studies by integrating the technologies and engineering procedures which are developed in the competencies of this modules
- LO4: To transfer some parts of an engineering problem to the laboratory, and utilize this resource as support to resolve it.

The table below shows the relation between the competencies developed during the course and the envisaged learning outcomes:

Competencies	Learning outcomes
CB2, CB3, CB5, CT1, CT12, CT18, CT19, CE17, CE18, CE19	**LO1.** Develop software for the control of the various elements of aircraft, and for the various instruments.
CB2, CB3, CB5, CT12, CT18, CT19, CE17, CE18, CE19	**LO2.** To conduct studies by integrating the technologies and engineering procedures which are developed in the competencies of this modules
CB2, CB3, CB5, CT12, CT18, CE18, CE17, CE19	**LO3.** From a series of requirements, and prior information, to conceptualize an engineering problem, proposes an approach to solve it, and obtain the better solution. All this related to the competencies of this module
CB2, CB3, CB4, CB5, CT12, CT18, CT19, CE17, CE18, CE19	**LO4.** To transfer some parts of an engineering problem to the laboratory, and utilize this resource as support to resolve it.

4. CONTENT

The course covers the content stated in the official description of the Degree:

- Fundamentals of digital electronics and microprocessors
- Sensors and actuators
- Automatic digital control
- Avionics
- Air navigation systems

In order to do that, the course material is organized in eight learning units as shown below:

- Unit 1. Introduction to Digital Circuits
- Unit 2. Combinational Circuits
- Unit 3. Sequential Circuits
- Unit 4. Introduction to Digital Systems
- Unit 5. Introduction to Control Theory
- Unit 6. Introduction to Flight Management and Guidance Systems
- Unit 7. Introduction to Aeronautical Navigation Systems

5. TYPES OF EDUCATIONAL ACTIVITIES

In this course, next types of educational activities will be applied.

- Lecture-based class
- Integration of team work
- Self study
- Mentoring, academic monitoring and assessment

6. EDUCATIONAL ACTIVITIES

Relationship between the different educational activities and student work related to them in hours.

Actividad formativa	Número de horas
Lecture-based class	40
Lab Exercises	20
Integration of team work	50
Self study	60
Mentoring, academic monitoring and assessment	20
TOTAL	**150**

7. ASSESSMENT

Next, the evaluation systems are related, as well as their weight on the total grade of the subject:

Assessment system	Weight
Exams, tests and other knowledge test	30-35%
Elaboration of articles, reports or reports	15-30%
Alternative evaluation techniques	15-30%
Field experiences, conferences and visits	10%
Transversal competences (rubrics)	10-15%

In the Virtual Campus, when you access the subject, you will be able to consult in detail the evaluation activities that you must carry out, as well as the delivery dates and the evaluation procedures of each one of them.

7.1. Ordinary exam call

To pass the subject in ordinary call you must obtain a grade greater than or equal to 5.0 out of 10.0 in the final grade (weighted average) of the subject.

In addition to that, it will be necessary for you to obtain a grade greater than or equal to 5.0 in both, the final exam and in averaged grade of labs.

7.2. Extraordinary exam call

To pass the subject in ordinary call you must obtain a grade greater than or equal to 5.0 out of 10.0 in the final grade (weighted average) of the subject.

In addition to that, it will be necessary for you to obtain a grade greater than or equal to 5.0 in both, the final exam and in averaged grade of labs.

The failed activities in ordinary call must be delivered, after having received the corresponding corrections to them by the teacher. Also, undelivered or unrealized activities, should be realized/delivered.

The grade in extraordinary call will be considered as NP (Not Submitted/No Attendance/Not show up) when the student has not delivered or done any new activity with respect to what was presented in the ordinary call.

8. SCHEDULE

This section indicates the schedule with delivery dates of evaluable activities of the subject:

Assessed activities	Approximated dates
Digital circuits. Exercises	Weeks 1-3
Lab Exercise 1. Standard combinational circuits.	Weeks 2-4
Lab Exercise 2. Standard sequential circuits.	Weeks 3-5
Lab Exercise 3. Finite State Machines	Weeks 5-8

Lab Exercise 4. Digital systems	Weeks 7-9
Lab Exercise 5. Introduction to Control Theory	Weeks 8-10
First Exam	Weeks 7-10
Final Exam	Weeks 16-18

This schedule may undergo modifications for logistical reasons of the activities. Any modification will be notified to the student in a timely manner.

9. BIBLIOGRAPHY

Here is the basic recommended bibliography:

1. T. L. FLOYD. “Digital Fundamentals”, 11th edition. Ed. Pearson, 2014.
2. 2. ANDREW S. TANENBAUM. “Structured computer organization”, 6th edition. Ed. Pearson, 2012.
3. WILLIAM STALLINGS. “Computer Organization and Architecture”, 10th edition. Ed. Pearson, 2015.
4. KATSUIKO OGATA. “Modern Control Engineering”, 5th Edition. Pearson, 2009.
5. M. KAYTON and W. R. FRIED. “Avionics Navigation Systems”, 2nd Edition. John Wiley and Sons, 1997.
6. J. GONZÁLEZ BERNALDO DE QUIRÓS. “Localización Aeronáutica: radioayudas, radar y GPS”. Ed. Bellisco, 2010.
7. M. T. WYATT. “Aircraft Communication and Navigation Systems: Principles, Operation and Maintenance”. Routledge, 2011.
8. P. Z. PEEBLES. “Radar Principles”. Wiley-Interscience, 1998.
9. M. SKOLNIK. “Introduction to Radar Systems”, 3rd Edition. Mc-Graw-Hill Education, 2002.
10. D. H. TITTERTON and J. L. WESTON. “Strapdown Inertial Navigation Technology”, 2nd Edition. Institution Electrical Engineers, 2004.
11. B. L. STEVENS, F. L. LEWIS and E. N. JOHNSON. “Aircraft Control and Simulation: Dynamics, Controls Design, and Autonomous Systems”, 3rd Edition. Wiley-Blackwell, 2015.
12. Manuals and documentation of aircrafts, simulation tools and aviation professional organizations.

10. DIVERSITY CARE UNIT

Students with specific educational support needs:

Adaptations or curricular adjustments for students with specific educational support needs, in order to guarantee equal opportunities, will be guided by the Diversity Attention Unit (UAD).

The issuance of a report of curricular adaptations / adjustments by said Unit will be essential, so that students with specific educational support needs should contact through: unidad.diversidad@universidadeuropea.es at the beginning of each semester.