

300246 - MET - Meteorology

Coordinating unit:	300 - EETAC - Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit:	748 - FIS - Department of Physics
Academic year:	2018
Degree:	BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERINGS/BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING - NETWORK ENGINEERING (AGRUPACIÓ DE SIMULTANEÏTAT) (Syllabus 2015). (Teaching unit Compulsory) BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING (Syllabus 2015). (Teaching unit Compulsory) BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING/BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2015). (Teaching unit Compulsory) BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING/BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2015). (Teaching unit Compulsory)
ECTS credits:	3
Teaching languages:	English

Teaching staff

Coordinator:	Pino González, David
Others:	Mazon Bueso, Jordi

Prior skills

- Operations with mechanics and thermodynamics concepts and laws and basic fluid mechanics concepts (the content of the four Physics subjects in semesters 1A, 1B, 2A and 2B).
- Operations in the differential and integral calculus of vector fields (double and triple integrals, gradient, divergence and curl) and an understanding of vector theorems (the content of Further Mathematics in semester 1B).
- Operations with ordinary differential equations (the content of Algebra and Geometry in semester 1A) and a basic understanding of linear partial differential equations and numerical differentiation (the content of Further Mathematics II in semester 2B).

Requirements

Fluid Mechanics

Degree competences to which the subject contributes

Specific:

1. CE 18 AERO. Conocimiento adecuado y aplicado a la Ingeniería de: Los fundamentos de la mecánica de fluidos; los principios básicos del control y la automatización del vuelo; las principales características y propiedades físicas y mecánicas de los materiales. (CIN/308/2009, BOE 18.2.2009)
2. CE 23 AEROP. Conocimiento aplicado de: edificación; electricidad; electrotecnia; electrónica; mecánica del vuelo; hidráulica; instalaciones aeroportuarias; ciencia y tecnología de los materiales; teoría de estructuras; mantenimiento y explotación de aeropuertos; transporte aéreo, cartografía, topografía, geotecnia y meteorología. (CIN/308/2009, BOE 18.2.2009)
3. CE 25 AERON. Conocimiento aplicado de: Transmisores y receptores; Líneas de transmisión y sistemas radiantes de señales para la navegación aérea; Sistemas de navegación; Instalaciones eléctricas en el sector tierra y sector aire; Mecánica del Vuelo; Cartografía; Cosmografía; Meteorología; Distribución, gestión y economía del transporte aéreo. (CIN/308/2009, BOE 18.2.2009)

Transversal:

- 05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
- 07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with

300246 - MET - Meteorology

recommended information sources according to the guidelines set by lecturers.

03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

04 COE N1. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.

Learning objectives of the subject

At the end of the course, the student should be able to:

- To identify the different layers of the atmosphere and the main characteristics and dynamics of these layers, the atmospheric composition, and atmospheric phenomena in the troposphere.
- To define the fundamental physical variables: pressure, temperature, humidity,, density that drives the atmospheric dynamics.
- To understand the origin of horizontal movements of the air: advection, geostrophic wind, gradient wind, thermal winds, and how they affect to Navigation
- To understand how the air vertical movements are originated: convection, turbulence, and how they affect navigation.
- To understand the importance of water vapor in the atmosphere, its measurement, phase changes and the formation of fog and clouds, and his influence on navigation and surface operations.
- To understand the physics of clouds, and to be able to identify the 10 basic genres and associated meteorological phenomena. To learn how to forecast the weather from watching them. To know how the thunderstorms originates and precipitation.
- To know and understand the factors and hazards that affect navigation, the prevention tools and risk minimization of Navigation: CAT, icing, visibility, turbulence.
- To understand the basics of synoptic meteorology.
- To be able to understand and explain weather reports.
- To understand the meteorological aspects of flight planning.
- To read and interpret technical documents written in English related to fluid mechanics and learn to express themselves in written and spoken English in the context of the subject project.

Study load

Total learning time: 75h	Hours large group:	25h	33.33%
	Guided activities:	8h	10.67%
	Self study:	42h	56.00%

300246 - MET - Meteorology

Content

<p>Introduction: atmospheric characteristics and energy budget</p>	<p>Learning time: 7h Theory classes: 2h Guided activities: 1h Self study : 4h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Presentation and previous concepts. Meteorological scales. Importance of meteorology and climatology in aviation. - Definition, structure and composition of the atmosphere. - Main variables used to study the atmosphere: temperature, pressure, density, wind speed and direction. Units of measurement. - International Standard Atmosphere. The hydrostatic approximation. - Thermal equilibrium of the atmosphere. Black bodies: Wien, Stephan-Boltzman equations. Solar radiation. Solar constant. The greenhouse effect on Earth. <p>Related activities:</p> <p>AV1: short exam AV2 and AV3: mid semester and final exams. AV5: resolution of problems and short questions..</p>	
<p>Atmospheric dynamics</p>	<p>Learning time: 23h Theory classes: 8h Guided activities: 2h Self study : 13h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Stability of the atmosphere. Vertical movements. - Turbulence and winds in the atmosphere. Different types of wind depending on their horizontal scale: micro and mesoscale systems. - Altimeter settings on a plane or airport. Problems and relation with atmospheric pressure and temperature. - Main isobaric features: cyclones, anticyclone, ridge, trough - Wind shear. CATs <p>Related activities:</p> <p>AV1: short exam AV2, AV3: mid semester and final exams. AV5: resolution of problems and short questions.</p>	

300246 - MET - Meteorology

<p>Water in the atmosphere: humidity, clouds, and precipitation</p>	<p>Learning time: 17h Theory classes: 4h Guided activities: 2h Self study : 11h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Water vapor in the atmosphere: pressure, condensation. Definitions of humidity. - Stability of the saturated air. Cloud formation. - Precipitation. Types of precipitation. Influence to the aircraft structure and performance. Icing. - Clouds classification: description, observation keys, and influence to the flight conditions. Cloud base and ceiling. Main weather phenomena associated to clouds. Condensation trails. - Thunderstorms. <p>Related activities:</p> <p>AV2 and AV3: mid semester and final exams. AV5: resolution of problems and short questions.</p>	
<p>General circulation and synoptic meteorology</p>	<p>Learning time: 12h Theory classes: 4h Guided activities: 2h Self study : 6h</p>
<p>Description:</p> <ul style="list-style-type: none"> - The Global Atmospheric Circulation. Distribution of Low and High atmospheric pressure on Earth. Cyclones and anticyclones. Major atmospheric circulation features: cells, belts, jet stream, Rossby waves. - Geostrophic wind, gradient wind. - Air masses: origin and effect on the weather. - Fronts: types, associated precipitation and flight conditions. <p>Related activities:</p> <p>AV3: final exams. AV5: resolution of problems and short questions.</p>	

300246 - MET - Meteorology

<p>Meteorological hazards for aviation</p>	<p>Learning time: 6h Theory classes: 2h Self study : 4h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Visibility. Causes of atmospheric obscurity - Differentiate between the different types of visibility: horizontal visibility, slant visibility, prevailing visibility, RVR - Icing: Definition, formation and types of icing. - Significance of both hazards to aviation. - Turbulence at low levels. Definition. Orographic waves, rotors, wind shear. - CAT - Thunderstorms and severe weather. - Relation of meteorological hazards on fly phases. - Climate change and aviation: influence and impacts of climate change on aviation. <p>Related activities:</p> <p>AV3: final exam. AV4: project.</p>	
<p>Meteorological information for aviation</p>	<p>Learning time: 10h Theory classes: 5h Guided activities: 1h Self study : 4h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Message and local reports: METAR, SPECI, TAF, SIGMET. - Significant weather maps. - Flight plans. - Weather forecast from numerical models. <p>Related activities:</p> <p>AV3: final exam. AV4: project. AV5: resolution of problems and short questions.</p>	

Qualification system

The final mark will be calculated as follows: $0.15 \cdot C + 0.15 \cdot P + 0.3 \cdot ME + 0.4 \cdot FE$, where

ME = Mid term exam (individual)

FE = Final exam (individual)

C = control (individual)

P = Project

300246 - MET - Meteorology

Bibliography

Basic:

Federal Aviation Administration. Aviation Weather: FAA Advisory Circular (AC) 00-6B (FAA Handbooks series) [on line]. [Consultation: 30/05/2017]. Available on: <https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_00-6B.pdf>.

Stull, Roland B.; Ahrens, C. Donald. Meteorology for scientists and engineers. 2nd ed. Pacific Grove (Calif.): Brooks/Cole, 2000. ISBN 0534372147.

Ahrens, C. Donald. Meteorology today : an introduction to weather, climate, and the environment. 8th ed. Pacific Grove, CA: Thomson/Brooks/Cole, 2007. ISBN 9780495011620.

Lester, Peter F. Aviation weather. Englewood, Colo: Jeppesen Sanderson, 2013. ISBN 9780884875949.

Complementary:

Collins, Richard L. Flying the weather map. 2nd ed. Newcastle: Aviation Supplies & Academics, 1999. ISBN 1560273194.

Ackerman, Steven A.; Knox, John. Meteorology : understanding the atmosphere. 2nd ed. Pacific Grove, CA: Thomson Learning, 2007. ISBN 0495108928.