300246 - METEO - Meteorology

Coordinating unit: 300 - EETAC - Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 748 - FIS - Department of Physics
Academic year: 2017
Degree: 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 TELECOMMUNICATIONS SYSTEMS ENGINEERING - NETWORK ENGINEERING (AGRUPACIÓ DE SIMULTANEITAT) (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 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
- Operativitat amb els conceptes i les lleis de la mecànica, la termodinàmica i conceptes bàsics de la mecànica de fluids continguts en les quatre assignatures de física dels quadrimestres 1A, 1B, 2A i 2B.
- Operativitat en el càlcul diferencial i integral de camps vectorials (integrals dobles i triples, gradient, divergència i rotacional) i comprensió dels teoremes vectorials, continguts de l'assignatura Ampliació de Matemàtiques de l'1B.
- Operativitat en equacions diferencials ordinàries, contingent de l'assignatura Algebra i geometria de l'1A, i nocions sobre equacions en derivades parcials lineals i sobre aproximació numèrica de derivades, continguts de l'assignatura Ampliació de Matemàtiques 2 del 2B.

Requirements
Thermodynamics

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; 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
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**

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours large group: 25h</th>
<th>33.33%</th>
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<tbody>
<tr>
<td>Hours medium group: 0h</td>
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<tr>
<td>Hours small group: 0h</td>
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<tr>
<td>Guided activities: 8h</td>
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<td>10.67%</td>
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<tr>
<td>Self study: 42h</td>
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<td>56.00%</td>
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</table>
## Content

### Introduction. Atmospheric energy budget

**Learning time:** 7h  
Theory classes: 2h  
Guided activities: 1h  
Self study: 4h

**Description:**  
- 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.  

**Related activities:**  
AV1: short exam  
AV2 and AV3: mid semester and final exams.  
AV5: resolution of problems and short questions.

### General circulation and synoptic meteorology

**Learning time:** 12h  
Theory classes: 4h  
Guided activities: 2h  
Self study: 6h

**Description:**  
- Geostrophic wind, gradient wind.  
- Air masses: origin and effect on the weather.  
- Fronts: types, associated precipitation and flight conditions.

**Related activities:**  
AV1: short exam  
AV2 and AV3: mid semester and final exams.  
AV5: resolution of problems and short questions.
# Atmospheric dynamics

**Description:**
- 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

**Related activities:**
AV2, AV3: mid semester and final exams.
AV5: resolution of problems and short questions.

**Learning time:** 23h
- Theory classes: 8h
- Guided activities: 2h
- Self study: 13h

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# Water in the atmosphere: humidity, clouds, and precipitation

**Description:**
- Water vapor in the atmosphere: pressure, condensation. Definitions of humidity.
- Stability of the saturated air. Cloud formation.
- Clouds classification: description, observation keys, and influence to the flight conditions. Cloud base and ceiling. Main weather phenomena associated to clouds. Condensation trails.
- Thunderstorms.

**Related activities:**
AV3: final exam.
AV5: resolution of problems and short questions.

**Learning time:** 20h
- Theory classes: 7h
- Guided activities: 2h
- Self study: 11h
### Meteorological hazards for aviation

**Description:**
- 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.

**Related activities:**
AV3: final exam.
AV4: project.

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<tr>
<th>Learning time: 6h</th>
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<tr>
<td>Theory classes: 2h</td>
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<tr>
<td>Self study: 4h</td>
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### Meteorological information for aviation

**Description:**
- Message and local reports: METAR, SPECI, TAF, SIGMET.
- Significant weather maps.
- Flight plans.
- Weather forecast from numerical models.

**Related activities:**
AV3: final exam.
AV4: project.
AV5: resolution of problems and short questions.

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<thead>
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<tr>
<td>Theory classes: 2h</td>
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<td>Guided activities: 1h</td>
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<tr>
<td>Self study: 4h</td>
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### Qualification system

The final mark will be calculated as follows: 
\[0.15 \times C + 0.15 \times P + 0.3 \times ME + 0.4 \times FE\]
where
- \(ME\) = Mid term exam (individual)
- \(FE\) = Final exam (individual)
- \(C\) = control (individual)
- \(P\) = Project
Bibliography

Basic:


Complementary:
