19388 - AW - Aviation Weather

Coordinating unit: 300 - EETAC - Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 748 - FIS - Department of Physics
Academic year: 2018
Degree: MASTER’S DEGREE IN AEROSPACE SCIENCE AND TECHNOLOGY (Syllabus 2015). (Teaching unit Optional)
MASTER’S DEGREE IN AEROSPACE SCIENCE AND TECHNOLOGY (Syllabus 2009). (Teaching unit Optional)
ECTS credits: 5 Teaching languages: English

Teaching staff
Coordinator: Defined at the course web page

Prior skills
To be able to operate with the concepts and laws of mechanics, thermodynamics and fluid mechanics.

To be able to operate in differential and integral calculus of vector fields.

Teaching methodology
The contents of the course will be explained by showing during the theory lessons by combining blackboard and slides

Learning objectives of the subject
At the end of the course, the student should be able to:
- Identify the different layers of the atmosphere and their main characteristics, the atmospheric composition and atmospheric phenomena in the troposphere.
- To define the fundamental physical variables: pressure, humidity, density, and temperature that drives atmospheric dynamics.
- Understand the thermal equilibrium, the radiative balance and stability of the atmosphere and apply them to flying conditions.
- Understand the origin of the horizontal and vertical movements of the air and how they affect to aviation.
- Understand the importance of water vapour in the atmosphere, its measurement, phase changes, and the formation of fog and clouds, and its influence on aviation.
- Understand the physics of clouds, and to be able to identify the 10 basic types, and associated weather phenomena.
- Know how precipitation occurs and how thunderstorms are formed and develop.
- Know the main hazards affecting aviation: CAT, icing, visibility, turbulence and how to forecast and avoid them.
- Understand the basics of general circulation and synoptic meteorology.
- Be able to understand and explain METARs, SIGMETs, significant weather charts.
- To understand the meteorological aspects of flight planning.
### Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours large group: 45h</th>
<th>36.00%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
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<tr>
<td></td>
<td>Hours small group: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Guided activities: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study: 80h</td>
<td>64.00%</td>
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## Content

<table>
<thead>
<tr>
<th><strong>Introduction</strong></th>
<th><strong>Learning time:</strong> 11h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 3h</td>
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<tr>
<td></td>
<td>Self study : 8h</td>
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</tbody>
</table>

- 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.

<table>
<thead>
<tr>
<th><strong>Heat, stability and atmospheric dynamics</strong></th>
<th><strong>Learning time:</strong> 32h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 10h</td>
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<tr>
<td></td>
<td>Guided activities: 2h</td>
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<td>Self study : 20h</td>
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</tbody>
</table>

- 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

<table>
<thead>
<tr>
<th><strong>Water in the atmosphere: humidity, clouds and precipitation</strong></th>
<th><strong>Learning time:</strong> 24h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td></td>
<td>Guided activities: 2h</td>
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<tr>
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<td>Self study : 16h</td>
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</tbody>
</table>

- 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.
## General circulation and synoptic meteorology

**Learning time:** 18h  
Theory classes: 4h  
Guided activities: 2h  
Self study: 12h

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

## Meteorological information for aviation

**Learning time:** 19h  
Theory classes: 4h  
Guided activities: 3h  
Self study: 12h

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

## Meteorological hazards for aviation

**Learning time:** 21h  
Theory classes: 8h  
Guided activities: 1h  
Self study: 12h

**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.

## Qualification system

It will be defined in the web of the course
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Regulations for carrying out activities

All the activities to be evaluated are compulsory. Any exam or deliverable not presented on time will be evaluated with a zero mark. All the evaluations are individual

Bibliography

Basic:


Complementary: